1982-83 Bulletin of the University of Rhode Island

Graduate School

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The University

The University of Rhode Island is a medium-sized state university located in the southern part of Rhode Island in the village of Kingston. As a land-grant college since its founding in 1892, it emphasizes preparation for earning a living and for responsible citizenship, carries on research, and takes its expertise to the community through its extension programs. In part because of its unique location near the ocean and six miles from Narragansett Bay, the University has developed strong marine programs and has been designated one of the national sea grant colleges.

The University enrolls about 11,000 students on its Kingston campus, and another 4,000 in credit courses throughout the state. There are about 13,000 undergraduate students, about 2,500 graduate students, and a full-time teaching faculty of about 800. Approximately 1,000 graduate students are in full-time residence.

The University has nine colleges and three schools: the Colleges of Arts and Sciences, Business Administration, Continuing Education, Engineering, Human Science and Services, Nursing, Pharmacy, Resource Development, University College, the Graduate School, the Graduate Library School, and the Graduate School of Oceanography.

The Campus. The University has a spacious rural campus 30 miles south of Providence in the northeastern metropolitan corridor between New York and Boston. The center of campus is a quadrangle of handsome old granite buildings surrounded by newer academic buildings, student residence halls, and fraternity and sorority houses. On the plain below Kingston Hill are gymnasiums, athletic fields, tennis courts, a freshwater pond, agricultural fields, and greenhouses.

In addition to the Kingston campus, the University has three other campuses. Six miles to the east, the 165-acre Narragansett Bay Campus, overlooking the west passage of the Bay, is the site of the Graduate School of Oceanography with academic and research buildings, and docks for research vessels. The Rhode Island Atomic Reactor and several federal laboratories devoted to marine sciences are also located there. The College of Continuing Education, with main offices at 199 Promenade Street in Providence, offers courses throughout the state. The W. Alton Jones Campus is in the western section of the state, 20 miles from Kingston. Its 2,300 acres of woods, fields, streams, and ponds is the site of environmental education, research, and conference facilities.

Graduate Study

Graduate study at the University was inaugurated in 1907 with the Master of Science degree in chemistry and in engineering. The Master of Arts degree was first awarded in 1951, and in 1960 the University awarded its first Doctor of Philosophy degree. Graduate work for professional degrees was initiated in 1962 when the degree of Master of Public Administration was first awarded. Today, the master's degree is offered in over 60 areas of study and the doctorate in 29 areas.

The Dean of the Graduate School has primary responsibility for administering the policies and procedures relating to advanced study at the University of Rhode Island. Graduate School policy is made by the Graduate Faculty, acting through its delegate body, the Graduate Council, which includes student members. Only the dean or the Graduate Council may grant exceptions to the regulations for graduate study, which are explained in detail in the *Graduate School Manual.*

The University graduate programs of study are listed below. Work in a combination of special areas is usually possible. Graduate-level coursework applicable to a number of these programs is offered in several locations throughout the state by the College of Continuing Education. In most cases, however, a portion of the coursework will have to be taken on the Kingston Campus.

In addition, two graduate certificate programs are available to supplement specific master's degrees. The graduate certificates, which are not degrees, are awarded by the Dean of the Graduate School to attest to a specific, supple-

Graduate Degree Programs

Master of Arts

Audiology

Comparative Literature

Economics

Education
- •Education Research
- •Elementary Education
- •Guidance and Counseling
- •Reading Education
- •Science Education
- •Secondary Education
- •Youth and Adult Education

English

French

Geography

History

Marine Affairs

Philosophy

Political Science
- •International Relations

Sociology

Spanish

Speech-Language Pathology

Master of Science

Accounting

Animal Pathology

Animal Science

Audiology

Biochemistry-Biophysics

Botany

Business Education

Chemical Engineering

Chemistry

Child Development and Family Relations
- •Marriage and Family Counseling

Civil and Environmental Engineering

Computer Science

Electrical Engineering

Environmental Health Sciences

Experimental Statistics

Food Science and Nutrition

Geology

Home Economics Education

Industrial Engineering

Mathematics

Mechanical Engineering and Applied Mechanics

Medicinal Chemistry

Microbiology

Nursing

Ocean Engineering

Oceanography

Pharmacognosy

Pharmacology and Toxicology

Pharmacy

Pharmacy Administration

Physical Education

Physics

Plant and Soil Science

Plant Pathology-Entomology

Psychology (school)

Resource Chemistry

Resource Economics

Speech-Language Pathology

Textiles, Clothing and Related Art

Zoology

Doctor of Philosophy

Applied Mathematical Sciences
- •Applied Mathematics
- •Computer Science
- •Operations Research
- •Statistics
- •Applied Probability

Biological Sciences
- •Animal Pathology
- •Biochemistry-Biophysics
- •Botany
- •Food Science and Nutrition
- •Microbiology
- •Plant Pathology
- •Resource Chemistry
- •Zoology

Chemical Engineering

Chemistry

Civil and Environmental Engineering

Economics-Marine Resources

Electrical Engineering
- •Biomedical Engineering

English

Mathematics

Mechanical Engineering and Applied Mechanics

Ocean Engineering

Oceanography

Pharmaceutical Sciences
- •Medicinal Chemistry
- •Pharmacognosy
- •Pharmacology and Toxicology
- •Pharmacy

Physics

Psychology

Professional Degrees

Master of Business Administration (M.B.A.)

Master of Community Planning (M.C.P.)

Master of Library Science (M.L.S.)
- •Diploma in Advanced Librarianship (D.A.L.)

Master of Marine Affairs (M.M.A.)

Master of Music (M.M.)

Doctor of Pharmacy (Pharm.D.)

Master of Public Administration (M.P.A.)

mental competence in Commercial Fisheries (see Marine Affairs, p. 62) or in International Development Studies (see International Studies, p. 57).

Research

Within Rhode Island's system of higher education, the University has the major responsibility for graduate study which is closely associated with a strong program of research. Specialized marine research, education, and public service projects are carried on in many departments. Active research throughout the University is supported by a total of approximately $21 million per year. Support comes from foundations, commercial firms, federal and state government, and the University.

The Coordinator of Research signs, on behalf of the University, applications for research grants, maintains files of funding agencies, keeps a current facilities inventory, and is liaison for the president, the business manager, the academic deans, the Research Committee, and the faculty in matters pertaining to general research policy.

Research Resources

The University Libraries. The library collection of over 712,000 bound volumes and 732,000 volume-equivalent microforms is housed in the University Library in Kingston, at the College of Continuing Education in Providence, and the Claiborne Pell Marine Science Library on the Narragansett Bay Campus. The latter was designated the National Sea Grant Depository in 1971.

The University Library, which holds the bulk of the collection, has open stacks with direct access to books, periodicals, documents, maps, microforms, and audiovisual materials. The Special Collections Department collects and maintains rare books, manuscripts, the University archives, and a variety of special interest materials. Service hours at the other libraries vary, but the University Library provides full reference, bibliographic, and circulation services during most of the 90 hours per week it is open. Terminals linked to the Academic Computer Center are available in the library during the hours both facilites are operating. A computer-based bibliographic system makes most books available to users one week after their receipt. Arrangements can be made to borrow out-of-print material from other libraries through the Interlibrary Loan Office in the University Library.

The Academic Computer Center. The Academic Computer Center has a National Advanced System (NAS) 7000N mainframe computer and a PRIME 750 minicomputer. Over 150 terminals may be attached simultaneously to these systems. Access to specific applications including remote independent computers is provided by a MICOM port selector. The mainframe uses modern IBM operating systems. A limited-function, high-performance interactive system is available primarily for instruction, and a full-function timesharing system is provided for research. The minicomputer is used for interactive research computing. Both systems have a full complement of programming languages and packages. The center has a CalComp 1051/906 plotter with extensive display and preview facilities for hard-copy graphics output. Graphics software packages include SYMAP, SYMVU, CALFORM, ASPEX, and FORTRAN callable subroutines. Interactive graphic facilities using Tektronix and ISC terminals are provided. Various types of typewriter and display terminals for interactive use or remote job entry are located on the campus in most of the science and engineering departments as well as the College of Business Administration, the College of Continuing Education, the College of Pharmacy, the University Library, and the Graduate School of Oceanography.

The staff develops and maintains programming systems and application programs, conducts short courses and workshops, and provides consultation on the facilities and their use. They also provide assistance in the purchase, rental, maintenance, and installation of small computers and telecommunications equipment.

Other Research Facilities. A PRIME 400 minicomputer which supports timesharing and intermediate-speed remote batch input is installed at the Narragansett Bay Campus. The College of Engineering has a Digital VAX 11/780 minicomputer with terminals in all engineering buildings and linked to the Academic Computer Center's system. The Department of Electrical Engineering has two Data General Eclipse and several microcomputer systems. A Nova 4/S computer with a 16-channel A to D converter, Versatec printer-plotter, a videographic terminal, and a hard disk system are located in the Department of Ocean Engineering. It has a microprocessor interface and a magnetic tape input/output system. A Tectronix 4051 minicomputer with a digitizer and a bed plotter, and a T.I. FS990/4 microcomputer with a 64-channel A-D converter are also available.

Other equipment includes major laboratories for digital pattern recognition and digital image processing, computer automation ("robotics"), optical properties of materials and microelectronics, and materials research, a mechanical properties testing facility, including an Instron 1125 and a MTS Series 810 testing machine and a NETZSCH 40916 thermal analyzer, a field station for radiopropagation research, reverberant and anechoic rooms for airborne acoustics work, a low speed wind tunnel for fluid mechanics studies, a zoom transfer scope, digital planimeter and radial plotter for applied remote sensing, instrumentation including atomic absorption, emission, infra-red, mass, nuclear magnetic resonance (H-1, C-13), Raman X-ray diffraction/fluorescence and ultraviolet spectrometers, gas and liquid chromatographs, gas chromatograph-mass spectrograph, electron microscopes, scanning electron microscopes, metallographs, nuclear counting equipment, and multichannel analyzers.

Equipment available for marine research includes chambers for leak testing equipment prior to deep-sea use, triaxial test chambers for soil and sediment testing, X-ray radiographs, a gamma-ray core scanner, a rotating basin for studying basic problems in oceanographic hydrodynamics, a wave and towing tank, underwater acoustics test facilities, a marine experimental aquarium, and a marine ecosystem research laboratory.

The University's research vessel, *Endeavor,* operated by the Graduate School of Oceanography, is a 177-foot ship capable of working in all parts of the world's oceans. It can carry a scientific party of 14. The R.V. *Edson Schock,* a 65-foot ocean engineering research vessel, and the *Dulcinea,* a 40-foot dragger are part of the permanent fleet.

A number of small vessels are also available.

Students of the University have a research reactor and associated facilities available to them at the Rhode Island Nuclear Science Center, located on the Narragansett Bay Campus. Constructed and operated by the state of Rhode Island, this critical reactor is extensively used for research by many departments of the University. The reactor, designed for 5MW is now operating at 2MW. Hot laboratories, counting equipment, and multichannel analyzers are also available.

The Speech and Hearing Center has one-way vision and listening facilities and diagnostic equipment for speech and language testing. Sound-treated testing rooms meeting ANSI standards and audiometric equipment provide for audiologic evaluation and research.

Research Units

In addition to the research in various departments, the following special research agencies have been established.

Agricultural Experiment Station. The station within the College of Resource Development is the designated Rhode Island/USDA partnership organization for research in the agricultural sciences. Basic and applied investigations in natural and human resources is carried on by 54 senior scientists assigned to college departments. The research aims at conservation and management of resources; improvement of the quality of environment, enhancement of home life, and support of resource-using business and industry. A strong orientation to estuarine and marine problems and an interdisciplinary approach to resource research are station characteristics. The progress of research and complete results of individual projects are issued in station bulletins. All are available to Rhode Island residents upon request.

Bureau of Government Research. The bureau is the research, consulting, and training arm of the University in the field of public administration, specializing in state and local government. It provides consulting services in the areas of general organization and management, budgeting and finance management systems, position classifications, pay plans and purchasing, and other administrative systems. The bureau maintains a reference library in public administration; publishes a newsletter and informational reports; and provides in-service training programs, seminars, and an information service for government officials.

Center for Atmospheric Chemistry Studies (CACS). The center is a focal point for the development of a broad scale research effort in atmospheric sciences at the University, provides a resource in atmospheric chemistry and air pollution research for the state of Rhode Island, and provides direction and leadership for several of multi-institutional, multi-national research programs examining global-scale problems in atmospheric chemistry.

Center for Energy Studies. The center brings together and expands energy-related research at the University and supports the energy activities of state agencies, commercial establishments, and individual citizens of the state. It coordinates campus programs and offers technical advice and educational programs on the subject of energy conservation.

Center for Ocean Management Studies (COMS). The center was established in 1976 to help develop new resource management concepts for the coastal and marine environment through an interdisciplinary approach. The center identifies ocean management issues, holds workshops and conferences to discuss them, and develops recommendations and research programs to resolve them. A steering committee is chaired by the Provost for Marine Affairs.

Core Facility. A center of expertise in the design and fielding of new deep-ocean sampling technology, it provides a wide range of services to an international user community in the area of equipment development as well as supporting the traditional geological sampling requirements of the marine community. It maintains a collection of historical geological samples, accessible to qualified investigators.

The Institute of Human Science and Services. The institute sponsors research and support activities in the human sciences and services, particularly in the areas of evaluation, measurement, survey research, curriculum development, training and human services policy and management. Institute activities focus on areas including education, human development, the family, gerontology, exercise science, consumer affairs, counseling, and public policy. The institute is an integral part of the College of Human Science and Services and draws its professional staff from all departments of the College. The Institute maintains close liaison with human service agencies such as the Rhode Island Department of Education, Rhode Island Social and Rehabilitative Services and the Rhode Island Institute of Mental Health, Rehabilitation and Hospitals.

Division of Marine Resources. The purpose of this division is to develop, package, and deliver information, technology, and research results which can be used by the marine community of the state, region, and nation. The division's broadly-based services are provided to units of government at all levels, business and industry, and the general public. It conducts specialized applied research investigations in cooperation with the Graduate School of Oceanography and with other URI research faculty who participate in the division's activities on a project-by-project basis. The division is the umbrella unit for the Marine Advisory Service, the Coastal Resources Center, the National Sea Grant Depository and the Regional Coastal Information Center.

Marine Advisory Service. The service provides field specialists and information to the marine community of the state and region under the public service responsibility of the URI Sea Grant Program. Projects include work with commercial fishermen, marina and boatyard operators, local and state governments, elementary and secondary schools, seafood processors, and individuals and businesses interested in the management, use, development, or understanding of marine resources.

Coastal Resources Center (CRC). CRC offers technical assistance in the form of studies and surveys aimed at solving marine and coastal management problems. It is a primary resource for

the state's Coastal Resources Management Council. It cooperates with departments throughout the University to produce reports and publications, and to sponsor research.

National Sea Grant Depository. Housed in the Claiborne Pell Marine Science Library, the depository was established in 1971 to ensure that materials published under sea grant auspices would be available at a single location. Its subject matter touches such widely diverse areas as aquaculture, law, medicine, geology, chemistry, biology, engineering, mathematical modeling, food technology, information retrieval, recreation, coastal zone management, and market research. The NSGD publishes an annual computer-produced index, makes available loan copies of documents, and conducts literature searches.

Historic Costume and Textiles Collection. An historic costume and textile collection of over 13,000 items is housed in the Department of Textiles, Clothing and Related Art. The collection, of national significance, features 18th and 19th century costumes, Weaver Rose Collection, early American quilts, shawls, and many international costumes. A full-time curator and faculty are available to assist scholars and museum professionals with problems of classification, identification, restoration and storage of textile items.

Human Performance Laboratory. The Human Performance Laboratory in the Department of Physical Education, Health and Recreation offers measurement and exercise counseling services to local, state, and regional agencies, industrial corporations, established exercise programs, athletic teams, and individuals with medical referrals. It is concerned with the total person and with the individual's response to the demands of physical evaluation and participation. The laboratory has facilities for exercise stress evaluation, medical examinations, chemical analyses of expired and blood gases, lectures and demonstrations.

International Center for Marine Resource Development (ICMRD). The center in the College of Resource Development exists to help other countries solve their marine resource problems through education, research, and extension programs, and to provide educational experiences for international students and guests. Its major sponsor is the U.S. Agency for International Development (AID). Current AID-sponsored projects aim to improve the small-scale fisheries in less-developed countries, to combat food shortages, and assist the new University of the Azores with fisheries and rural extension services. An AID-funded Strengthening Grant gives faculty and graduate students opportunities to participate in the center's overseas programs. Its subsidiary is the Consortium for the Development of Technology (CODOT) which has four member universities working in several Latin American countries.

Laboratories for Scientific Criminal Investigation. These laboratories in the Department of Pharmacology and Toxicology provide instruction, research, and service in the field of scientific criminal investigation. The laboratory staff works closely with the Rhode Island Attorney General's Office and also provides technical consultation for various law enforcement agencies, and special instruction and research in criminalistics, in which faculty members of various departments participate. The program sponsors a special course for police and law enforcement agencies.

Laboratories for Textile Performance Testing. These laboratories in the Department of Textiles, Clothing and Related Art are concerned with textile performance evaluation, fiber identification, and quality control. The laboratory staff works closely with state and University purchasing agents, Rhode Island Attorney General's Office, and also provides technical assistance to industry. Equipment is available for performing a wide range of tests recommended by the American Society for Testing Materials, American Society for Quality Control, American Association of Textile Chemists and Colorists as well as mandatory tests required by federal agencies.

Research Center in Business and Economics. The center initiates, conducts, and services the research activities of the faculty of the College of Business Administration in accounting, business education and office administration, business law, economics, finances, insurance, management science, marketing management, organizational management and industrial relations, and production and operations management. The center publishes *The New England Journal of Business & Economics* focusing on issues of concern to New England.

Rhode Island Water Resources Center. This is the state center for research and training in all phases of water resources. Similar centers in each of the 50 states and Guam, Puerto Rico, the Virgin Islands, and the District of Columbia were established by law in 1964 and work cooperatively with the federal government in an effort "to assist in assuring the nation at all times of a supply of water sufficient in quantity and quality to meet the requirements of its expanding population." Principal investigators of projects need not be employed at the University.

Robotics Research Center. The center involves undergraduates, M.S. and Ph.D. graduate students, staff and visiting engineers, and faculty in the Departments of Electrical, Mechanical, and Industrial Engineering. Their research deals with applications of advanced robot systems in industrial processes and the development of general methods for robots with vision to acquire, orient, and transport objects. Funding for the latter basic research is provided by the National Science Foundation (NSF). The research oriented to the needs and interests of industry is supported by over thirty companies involved both in the production of robots and in their employment in the production process. In April 1982, NSF provided further funding for the creation of the URI's University/Industry Cooperative Research Center in Robotics. URI research in robotics began in 1971.

Accreditation

The accrediting agencies which have approved the quality of the course offerings of the University of Rhode Island include the American Association of Universities, the American Assembly of Collegiate Schools of Business, the American Chemical Society, the American Council on Pharmaceutical Educa-

tion, the American Library Association, the Accreditation Board for Engineering and Technology, the National League for Nursing, the New England Association of Colleges and Secondary Schools, and the State University of New York.

The University is also an approved member institution of the American Association of University Women, the Council of Graduate Schools in the United States, the National Association of Schools of Music, the North American Association of Summer Sessions, and the National University Extension Association. The Doctor of Philosophy programs in clinical and school psychology are accredited by the American Psychological Association.

Graduate Life

The main campus of the University of Rhode Island is located in the quiet historic village of Kingston. Cultural variety and compact size are combined in the state of Rhode Island, and other cultural centers are easily accessible. Boston is 80 miles to the north and New York City 160 miles southwest. Direct bus service to these cities, as well as to Providence, Newport, and Cape Cod, is available from the campus. There is also a local bus service. The Kingston station of Amtrak is two miles away.

Services. The recreational and cultural facilities of the campus are open to graduate students and include use of the Memorial Union building. Facilities there include meeting and conference rooms, lounges, browsing room, study rooms, dark rooms, student video center, radio station, campus newspapers, games room, offices for student organizations, student technical services, craft center, cafeteria, snack bar, restaurant, pub, private dining rooms, ballroom, and party room. Services include a full service bank, travel agency, unisex hair salon, credit union, and a center where copying facilities and typewriters are available. Student cooperatives under the direction of the Student Senate include a record shop, photography lab, housing directory, book exchange, and a student hostel. There are substantial facilities for commuting students.

Every effort is made to provide graduate students with opportunities for consultation and advice on matters of concern to them in their academic, extracurricular, and personal lives. Descriptions of available services and facilities, including those associated with religious life, may be found in the *Undergraduate Bulletin*. Of particular interest to graduate students are the following: Career Services and Counseling Center, Roosevelt Hall; Health Services, Potter Building; International Student Affairs, International House; Religious Counselors, Memorial Union and Catholic Center; Student Financial Aid Office, Roosevelt Hall.

Handicapped and Minorities. The University makes every effort to comply with all federal regulations relating to discrimination and accessibility for the handicapped. A large percentage of the buildings on campus are available to the handicapped, and special provision is made to assure that no student is prohibited from pursuing a course of study because of restricted access to buildings. Special counseling for physically, psychologically, or vocationally handicapped individuals is available from the Counseling Center.

The Dean of the Graduate School, the Director of Career Services, the Director of Counseling, and the Director of the (undergraduate) Special Program for Talent Development cooperate to provide information and guidance for economically and socially disadvantaged individuals seeking opportunities for graduate study at the University. Inquiries may be directed to any of these offices.

The University of Rhode Island prohibits discrimination on the basis of race, sex, religion, age, color, national origin, or handicap, and discrimination against disabled and Vietnam era veterans, in the recruitment, admission, or treatment of students; the recruitment, hiring, or treatment of faculty and staff, and the operation of its activities and programs. This is in compliance with state and federal laws, including Titles VI and VII of the Civil Rights Act of 1964 as amended, Title IX of the 1972 Education Amendments to the Higher Education Act, Executive Order 11246, as amended, Sections 503/504 of the Rehabilitation Act of 1973, and Section 402 of the Vietnam Era Readjustment Assistance Act of 1974. Inquiries concerning compliance with anti-discrimination laws should be addressed to the Affirmative Action Officer, University of Rhode Island. Questions regarding provisions for the handicapped should be directed to the Committee to Meet the Needs of the Handicapped.

Graduate Student Association. This organization is interested in both the academic and social aspects of graduate life. Officers and representatives of the association are elected annually from the entire graduate student body and the association is represented on the Graduate Council. The G.S.A. offices are located in the Memorial Union.

There are also organizations for spouses of graduate students and for students from foreign countries.

Housing. The Graduate Village and several older buildings provide 140 units of unfurnished apartments for graduate students. There is a waiting list for these; interested students should write to the University Housing Office for applications and for additional information. The majority of off-campus housing, located in nearby resort areas, is available only on a seasonal basis, from September to June. Since most of these rentals are five miles or more from campus, people without cars should also investigate the availability of public transportation. A local bus service connects the shopping and service areas in Wakefield with the

University. Some of the outlying resort areas, including Narragansett Pier, Scarborough, and Galilee are also included in the bus routes.

Housing information may be obtained from the University Housing Office and from advertisements in the *Narragansett Times,* a weekly local newspaper. In addition to providing information and applications for University housing, the Housing Office has available maps, bus schedules, rental booklets, and a graduate roommate file. A list of off-campus rooms, apartments, and houses available to graduate students is maintained in the commuter lounge at the Memorial Union.

Housing arrangements should be made as early as possible. The Housing Office, located in the Roger Williams Complex, is open Monday through Friday from 8:30 a.m. to 4:30 p.m. (telephone 401-792-2687).

Dining Services. Dining services are available for graduate students and their guests at any of the University dining halls. The Ram's Den in the Memorial Union provides additional services. At present, resident students have a choice of a 15-meal per week (Monday through Friday) contract or a 20-meal per week (Monday through Sunday) plan. Semester rates and weekly and monthly rates for commuters as well as guest rates and other information may be obtained from the Dining Services Office, Lippitt Hall.

Army ROTC. A two-year program has been designed to fill the needs of graduate students who have not taken Army ROTC during their undergraduate years. The United States Army offers the opportunity to earn commissions as second lieutenants after two years of on-campus ROTC training. The student attends a six-week basic summer camp and completes the advanced ROTC course while attending graduate school.

Academic and Social Codes. Each student is a member of the University community with all the rights, privileges, and responsibilities that go with such membership. The rights and privileges include full use of the educational opportunities and facilities offered on the campus. The responsibilities include those of making proper use of these facilities in order to progress educationally, respecting the rights of others, and knowing and obeying the rules and regulations developed by the University community for the good of the total membership.

The University expects that all course papers, theses, and dissertations will be prepared, and all examinations taken, in conformance with accepted standards of academic integrity. This includes the proper citation and attribution of all material which is not the original product of the writer. It is the graduate student's responsibility to determine the appropriate style used in his or her discipline for presentation of material derived from other sources and to adhere to it scrupulously in all written presentations. Where no special disciplinary style exists, that given in Kate L. Turabian's *A Manual for Writers of Term Papers, Theses, and Dissertations,* published by the University of Chicago Press, should be used.

University Ombudsman. The ombudsman investigates complaints from students, faculty, and administrative personnel that they have been unfairly dealt with in the normal channels of administrative process. An opportunity is thus provided for a personal appeal to an impartial official with broad perspective who has ready access at all levels to those involved in a grievance. The ombudsman is always available to receive complaints, inquire into the matters involved, and mediate or otherwise resolve the problem. However, the ombudsman does not become involved with the normal operations of established procedures as outlined in the *Graduate Student Manual,* except where they are not functioning as intended.

Confidentiality of Student Records

Procedures for the release and disclosure of student records maintained by the University are in large measure governed by state and federal laws. Where the law is silent, the University is guided by the principle that the privacy of an individual is of great weight and that as much information in a student's files as possible should be disclosed to the student upon request. A current or former student has the right to inspect or review official records, files, and data directly related to him or her. This right does not extend to applicants, those denied admission to the University, or those who were offered admission but did not enroll.

Some records not available to students are: letters of recommendation obtained or prepared before January 1, 1975; letters of recommendation which the student has waived his or her right to inspect; employment records of students as University employees; clinical, medical, counseling, or psychiatric records; parents' financial aid records; and campus law enforcement records.

A student may challenge the factual and objective elements of the content of student records, but not the qualitative and subjective elements of grading. If the student objects to certain items included in his or her personal records, a grievance procedure has been established. Ultimately, a Hearing Board on Student Confidential Records could render a decision.

Third parties do not have access to personally identifiable records or information pertaining to students without the written consent of students who specify the records to be released. Federal law requires that parents be considered third parties.

Detailed guidelines for the release and disclosure of information from student records are available from the Office of Student Life in the Memorial Union. They comply with the legal requirements of the Family Educational Rights and Privacy Act of 1974.

Notice of Change

Rules, regulations, dates, tuition, fees, the availability and titles of programs and areas of specialization, their administrative location, and courses set forth in this catalog are subject to change without notice. Where a change in program requirements is made while a graduate student is currently enrolled, the student may elect to complete the program under the requirements in effect at the time of matriculation, or to shift entirely to the new requirements, but may not choose parts of each set. As a result of the ongoing reviews of all graduate programs, certain offerings and specializations may be deleted or restructured between editions of the *Graduate School Bulletin.*

Degree Requirements

Each advanced degree awarded by the University requires as a minimum the successful completion of a specified number of approved credits of graduate study at the University and the passing of prescribed examinations. Credit hours for a master's or doctoral degree may include formal coursework, independent study, research, preparation of a thesis or dissertation, and such other scholarly activities as are approved ty the candidate's program committee and the Dean of the Graduate School.

It is the student's responsibility to know the calendar, regulations and pertinent procedures of the Graduate School and to meet its standards and requirements. These are set forth in this bulletin, the *Graduate Student Manual,* the *Statement on Thesis Preparation,* and other publications, all of which are available to graduate students at the Graduate School Office.

These documents govern both master's and doctoral degree programs. The manual gives detailed information on responsibilities of major professors and program committees, examination procedures, preparation of theses and dissertations, academic standards, and the Graduate Student Academic Appeals System.

The requirements immediately following are *general requirements* for all graduate students. *Specific requirements* for individual programs are itemized in the section on Graduate Programs.

Program of Studies

All degree candidates are required to prepare a program of studies with the guidance of their major professors (for master's degree programs) or of their program committees (for doctoral programs) in accordance with the guidelines in the *Graduate Student Manual.* After the program has been approved by the major professor for master's degree candidates or program committee for doctoral candidates as specified in the manual, the program of studies is to be submitted for approval to the Dean of the Graduate School.

The purpose of the program of studies is to ensure that students, at an early stage in their graduate study, organize coherent, individualized plans for their coursework and research activities. It is expected that the successful completion of the students' programs of studies along with collateral readings, research, etc., will enable them to demonstrate that they have achieved the high level of competence required of graduate students in their respective fields.

Course Numbering System

All regular graduate courses are numbered at the 500 and 600 levels. 900-level courses are special types of graduate courses for which no graduate program credit is given. Courses numbered at the 400 level are for advanced undergraduates, but may, with approval and to a limited extent, be accepted toward meeting degree requirements at the master's level. For doctoral candidates who have completed the master's degree in the same field or one closely related, all program work must be at the 500 or 600 level.

Scholastic Standing

Graduate work is evaluated by letter grades. All grades earned will remain on the student's record and, unless the courses were approved for no program credit prior to registration, all unacceptable grades will be included in calculating the student's scholastic average. Only grades of A and B carry graduate credit for courses below the 500 level. In 500- and 600-level graduate courses only grades of A, B, and C will be credited toward the degree.

A grade of C or lower in courses numbered below the 500 level is considered a failing grade. In such cases of failure the course must either be repeated, if it is a required course, or else replaced by another course approved by the candidate's program committee and the Dean of the Graduate School. When students receive more than one C in courses below the 500 level, their graduate status is subject to review by the Dean of the Graduate School.

Grades of D and F are failing grades in 500- and 600-level courses and require immediate review of the student's status. Courses failed at this level must be repeated, if they are required courses, or else replaced by another course approved by the candidate's program committee and the Dean of the Graduate School.

The grades S (satisfactory) and U (unsatisfactory) will be used for courses of study involving research undertaken for the thesis or dissertation and for certain courses and seminars so designated. The letter I (incomplete) is used for excused unfinished work. Incomplete grades assigned to graduate students may be removed within one calendar year. If the grade of I (incomplete) is not removed within one calendar year, it will remain on the transcript but may not be used for program credit. Grades of S, U and I are not included in the academic average.

To qualify for continuation in degree candidate status and for graduation, a cumulative average of B (3.0 on a 4.0 scale) in all work is required, except for courses meeting entrance deficiencies or approved for no program credit prior to registration in the course. At any time when the academic record indicates unsatisfactory performance, the student's status is subject to review. A student who fails to maintain a satisfactory grade point average or to make acceptable progress towards the degree may be dismissed as a graduate student.

Master's Degree Requirements

There are no major or minor area requirements for the master's degree. However, no degree can be awarded for the accumulation of credits without a planned program of study. Courses for the degree are expected to be concentrated in the candidate's field of interest and related areas to produce a well-developed and coherent program which will meet his or her special objectives.

Requirements for the master's degree must be completed within a period of four calendar years, or seven calendar years with special permission of the department and the Dean of the Graduate School if the study is done on a part-time basis. The master's degree may be earned either through full- or part-time study or by a combination of the two.

Candidates must take at least 80 percent of the credits required for the degree at the University of Rhode Island.

Some departments offer both a thesis and a non-thesis option while others offer only one plan. Please refer to the chapter on Graduate Programs for specific information on each program. The general requirements for these options are as follows.

Thesis Option. The minimum requirements for a master's degree are: (1) The successful completion of 30 credits, including 6 thesis research credits. (2) At the discretion of the department, the passing of written comprehensive examinations toward the end of the course-work. (3) The submission of an acceptable thesis and the passing of an oral examination in defense of the thesis. Four copies of the thesis prepared in accordance with Graduate School requirements must be submitted to the Graduate School Office. A statement on preparation of theses is available from that office.

Non-Thesis Option. Depending upon departmental requirements, some master's degrees may be earned without a thesis. The minimum requirements for a non-thesis master's degree program are: (1) The successful completion of a minimum of 30 credits. (2) Registration in advanced seminars, practicums, internships, or other experiences useful to the student's future professional career. (3) Registration in one course which requires a substantial paper involving significant independent study. (4) The passing of a written comprehensive examination toward the end of the course work. Some departments may also require a final oral examination.

Language. Although a language is not normally required for the master's degree, a student's major professor or thesis committee may require proficiency in a foreign language where appropriate for the subject chosen.

Professional Degree Requirements

Students should refer to the specific program requirements for professional degrees and consult with the appropriate dean or director.

Doctor of Philosophy Degree Requirements

The Doctor of Philosophy degree must be completed within seven years of the date when the student is first enrolled as a candidate.

The requirements for the doctor's degree are: (1) The completion of a minimum of 72 credit hours of graduate study beyond the baccalaureate degree, of which a minimum of 42 credit hours must be taken at the University of Rhode Island. (2) Satisfying the residence requirement that the student must maintain full-time residence for at least two consecutive semesters while acquiring the last 42 credits for the degree, but prior to taking the doctoral comprehensive examinations. Residence is interpreted as full-time attendance (9 credits or more) on campus or in the College of Continuing Education during a regularly scheduled semester. Full-time registration for both terms of a summer session counts as one semester of residence. With the exception of graduate assistants, instructors, research assistants, or equivalent, no candidate for the doctorate may count part-time study toward satisfying this residence requirement unless a specific request for an exception, outlining the reasons and alternate method of satisfying the requirement, is approved by the candidate's doctoral committee and submitted together with the candidate's program of studies for the approval of the Dean of the Graduate School. (3) If required by the department, proficiency in one or more foreign languages and/or in an approved research tool. (4) The passing of a qualifying examination. (5) The passing of a comprehensive examination. (6) The completion of a satisfactory dissertation. (7) The passing of a final oral examination in defense of the dissertation. The department in which the student studies for the doctor's degree may or may not require a master's degree preliminary to, or as part of, the regular course of study.

Qualifying Examination. This examination is intended to assess a student's potential to perform satisfactorily at the doctoral level, and is not a review of courses taken. A student without a master's degree who is accepted as a doctoral candidate is expected to take a qualifying examination, usually after 24-30 credits of coursework have been completed. A student who holds a master's degree in the same or a closely related field is normally not required to take the examination. If an examination is to be required, it will be stipulated in the letter of admission.

Comprehensive Examination. Each doctoral candidate shall take comprehensive examinations at or near but not later than 12 months after completion of the formal courses stipulated in the programs of study. The examination is designed to assess the student's intellectual capacity and adequacy of training for scholarly research.

The comprehensive examination consists of two parts: written, requiring a minimum of eight hours; and oral, requiring not more than two hours. The student, with the approval of his program committee, applies to the Graduate School to take the examination. The oral examination committee includes the student's committee and two additional members of the Graduate Faculty appointed by the Dean of the Graduate School. One of the additional members represents a field of study allied to that of the student's concentration. The candidate's major professor arranges for and chairs the examination. Unanimous approval by the examining committee is required for passing the comprehensive examination.

A candidate whose performance fails to receive unanimous approval of either examining committee may, upon the committee's recommendation, be permitted one reexamination in the part or parts failed, to be taken no sooner than ten weeks and no later than one year after the initial examinations.

Final Oral Examination. This examination is a defense of the dissertation and is open to all members of the faculty and, generally, to all students. The examination, usually two hours long, is conducted by an examining committee comprised of the candidate's program committee and two additional Graduate Faculty members appointed by the Dean of the Graduate School. One of the appointed members will be designated by the dean to chair the examination.

Unanimous approval of the examining committee is required for passing. If the candidate does not perform satisfactorily, the committee may recommend one reexamination under stated conditions.

Research Tool. Each department, in cooperation with the Graduate School, is authorized to formulate and to amend its own requirements and methods of testing for competency in research tools such as computer science, foreign language(s) or statistics. The department may, in turn, delegate this responsibility to the program committee for each individual doctoral candidate.

Theses and Dissertations

At least ten days prior to the proposed defense sufficient completed copies of the thesis or dissertation for members of the examining committee in acceptable form must be submitted to the Graduate School. At that time an additional copy must be placed on file in the Reserve Book Room of the Library.

For the oral defense, a sufficient number of completed copies of the thesis or dissertation, acceptable in form and substance to each member of the examining committee and the Dean of the Graduate School, is required. Following a successful defense and after all changes and corrections have been made, four copies prepared in accordance with Graduate School and Library requirements must be submitted to the Graduate School Office. Four copies of an abstract, not to exceed 350 words, are also required.

Students are advised to consult the *Statement on Thesis Preparation and Instructions for Thesis Defense* available in the Graduate School Office and the most recent edition of Kate L. Turabian's *A Manual for Writers of Term Papers, Theses, and Dissertations* published by the University of Chicago Press.

Admission and Registration

Admission

Persons holding the baccalaureate degree and wishing to take graduate-level courses at the University may do so through admission to the Graduate School as degree candidates, or may pursue postbaccalaureate work as non-matriculated students. Admission to the Graduate School is based upon academic qualifications and potential without regard to age, race, religion, sex, national origin, or handicap, or discrimination against disabled and Vietnam era veterans.

A set of application materials is appended to this catalog. Additional application forms may be obtained from the Graduate Admissions Office, University of Rhode Island, Kingston, Rhode Island 02881. Zip code should be included in the applicant's return address. Inquiries concerning particular degree programs or courses of instruction should be addressed to the appropriate department chairperson.

Applications and credentials are to be submitted to the Graduate Admissions Office. Final decision rests with the Dean of the Graduate School who, after obtaining the recommendation of the department concerned, notifies the applicant.

Where admission to a doctoral program is possible for those holding the bachelor's degree and meeting other requirements, the Graduate School reserves the right to offer admission only to the master's program while postponing a decision on admission to the doctoral program until at least a substantial portion of the master's work has been completed.

All applications must be accompanied by a $15 non-refundable application fee. Simultaneous application to more than one department requires duplicate applications and credentials and separate application fees.

General deadlines for receipt of applications and all supporting documents are April 15 for September or summer session admission, and November 15 for January admission. As is indicated in the Graduate Programs section of this bulletin, certain programs admit students only for September and/or have earlier deadlines. There is no assurance that applications completed after these dates will be processed in time for enrollment in the desired semester. Admission is offered for a specific entrance date only, and must be reconsidered if a postponement is subsequently requested.

Foreign Applicants. Applicants from foreign countries must complete the Test of English as a Foreign Language (TOEFL) with minimum scores of 500 for students applying for science programs and 550 for non-science programs, unless a different minimum is listed under the admission requirements for the specific program. All inquiries from foreign students concerning applications, fees, housing, etc., should be sent to the Director for International Student Affairs, International House.

Transfer Credit. Transfer credit may be requested for graduate work taken at other accredited institutions of higher learning. Such credits may not exceed 20 percent of the total credits required for the program. Ph.D. candidates holding a master's degree in the same or a closely related area may request up to 30 credits. The transfer work must have been taken at the graduate level (equivalent to the 500 level or higher in the University of Rhode Island course numbering system) and a passing grade earned at that institution must have been completed not more than five years prior to the date of request for transfer into a master's program (ten years for the doctoral program), and must have a clear and unquestioned relevance to the student's program of study. The request for transfer credit must have the approval of the student's major professor and the Dean of the Graduate School. If transfer credit is desired for work taken elsewhere after a graduate student is enrolled at this University, *prior approval* must be obtained from the Dean of the Graduate School.

Degree Candidates. Applicants must forward to the Graduate Admissions Office two completed application forms, two official copies of transcripts of all previous college work sent directly by

the issuing institutions, three letters of recommendation, and scores in the appropriate nationally administered tests. Tests required for specific programs may by found in the Graduate Program section of this bulletin.

To be accepted as a graduate degee candidate, applicants must maintain an average of approximately B (3.0 on a 4.0 scale) in their undergraduate work. Applicants with undergraduate averages below this level may be admitted upon the submission of other evidence of academic potential, i.e., satisfactory performance in postbaccalaureate work, professional experience as evidenced by publications or letters of recommendation, and/or high scores in the standardized test referred to above. All students are expected to maintain a cumulative average of B or better. Students who do not maintain a cumulative B average will have their status reviewed and may be placed on provisional status, be suspended, or be dismissed. A student placed on provisional status must achieve a cumulative B average within one semester (or nine credits, if part time) or be subject to suspension or dismissal.

Advanced Standing. A maximum of 12 credit hours of work taken at the University of Rhode Island in non-degree status may be applied toward degree requirements if the student is later admitted to a degree program, but only upon recommendation of the student's program committee and with the approval of the Dean of the Graduate School. Advanced standing for work taken at another institution, or obtained by examination or equivalency must also be included within this limit.

In certain cases, applicants who have been denied admission may be advised to take several courses in permanent non-degree status (see below) to provide a basis for later reconsideration of their applications. In such cases, these courses are usually regarded as though they were entrance deficiencies and are not accepted for advanced standing within minimum-credit programs of study.

Non-Matriculating (Non-Degree) Status. People holding a bachelor's degree who are not candidates for an advanced degree may take courses during the academic year or in the summer in non-matriculating status. Normally, to take courses for personal satisfaction or professional advancement, post-baccalaureate students enroll through the College of Continuing Education. However, if the work is being taken to provide a basis for later consideration for admission to degree status it may be advisable to apply for permanent non-degree status. Applicants for this status must file regular applications with statements of purpose and submit the required transcripts. However, letters of recommendation or scores on nationally administered tests are not required. Admission to permanent non-degree status will establish a permanent file in the Graduate School Office and in the department and permit advising of the student. Permanent non-matriculating students follow the same registration procedure as degree candidates. If non-matriculating students later wish to be admitted to a degree program they must complete the regular admission procedure.

Non-matriculating students do not have the privileges regularly enjoyed by degree candidates. For example, their enrollment is subject to the accomodation of degree candidates wishing to take these courses. In addition, there is a limit to the number of courses taken in this status that may be used as advanced standing to satisfy degree requirements.

Registration

The responsibility for being properly registered rests with the student. Students must register and complete their registration within the time period announced by the University. The chairperson of the student's major department will assign an advisor to assist the new graduate student in planning a program.

Registration for each semester consists of three separate procedures: registering for course selections, payment of fees, and obtaining a class program.

Registering for Course Selections. Students must obtain registration materials at the announced time and place. Currently enrolled students register in November for the spring semester and in April for the fall semester. Completed registration materials are submitted to the Registrar during the registration period, according to the announced instructions.

New and transfer students will be instructed concerning registration procedures.

Payment of Fees. Arrangements must be made with the Bursar for complete payment of tuition and/or fees by the due date. Class programs will be issued only for those students who have registered for course selections, and satisfied payment requirements with the Bursar.

Class Programs. Students may not attend classes without class programs. These are issued prior to the first day of classes according to instructions from the Office of the Registrar.

Drop and Add. Students are permitted to add courses and to drop courses with subsequent reassessment of fees (see page 18) during the first two weeks of classes. The final day to drop courses without a grade is midsemester.

Change of Address. It is the responsibility of the student to complete a change of address form in the Office of the Registrar whenever a change is made in the local, campus, or mailing address.

Summer Session. Although many graduate-level courses are offered during the summer session, the University does not guarantee that any particular course will be offered. The availability of individual faculty members to supervise research or to participate in comprehensive examinations and examinations in defense of theses or dissertations during the summer session varies from year to year. During the summer session, special arrangements must be made with both the Graduate School and the department for scheduling comprehensive examinations and thesis or dissertation defenses. Graduate students must make prior individual arrangements for taking directed studies or special problems courses.

Time Limit and Continuous Registration. Graduate students are expected to complete their course work and research within the four-year time limit prescribed for the master's degree and the seven-year time limit for the doctorate.

Graduate students are expected to remain continuously enrolled, except for summer sessions which are optional, until they have completed all requirements and have received their degree. Students who do not register for coursework or research and who do not comply with the regulations governing leaves of absence or withdrawal must pay the continuous registration fee each semester until the degree has been awarded. Upon application to the Dean of the Graduate School, the time limit for a degree program may be extended for such legitimate reasons as military service or serious illness. This request requires the endorsement of the student's major professor or department chairperson.

See the *Graduate Student Manual 1982,* Section 4, for regulations regarding leaves of absence, notification requirements, and circumstances under which graduate students will be assumed to have withdrawn from the University.

A student who does not register for a semester, or obtain approval for a leave of absence, will be considered as voluntarily withdrawn.

Full-time and Part-time Students. The normal full-time registration is 12 credit hours of study during a regular semester. Minimum full-time registration is nine credit hours during a regular semester and six credit hours during a summer term. Full-time registration is required of all students holding fellowships, full scholarships, and traineeships administered by the University. Students who do not meet the minimum full-time registration requirement are considered part-time students.

Off-campus Activity. Students who wish to register for credits to be counted toward a degree, and who will be earning these credits through off-campus activities such as research or independent study at a national laboratory, are required to obtain prior approval of the Dean of the Graduate School and to have these activities listed as part of their programs of study.

Intellectual Opportunity Plan (Pass/Fail Option). To allow graduate students to venture into new areas of knowledge without fear that their scholastic average will suffer, the Graduate Council has approved the Intellectual Opportunity Plan. To be eligible for this option, the student's major professor or adviser must certify that the course or courses are outside the student's major field of study, are not entrance deficiencies, and are not specific requirements of, but are relevant to, the student's program. A maximum of four credit hours may be taken by the master's degree candidate and a maximum of eight credit hours, including any taken as a master's candidate, by the Ph.D. candidate.

Credit by Examination or Equivalent. In master's programs only, a maximum of six credits may be allowed for competency based on experience outside the traditional academic setting and demonstrated by examination or equivalent. This maximum of six credits must fit within an overall maximum of 12 credits including program credit allowed for advanced standing and transfer credit, if any. See the *Graduate Student Manual 1982,* Section 7.30, for details of this procedure.

Audit. Courses may be audited with the approval of individual course instructors and by presenting an auditor's card secured from the Registrar. An auditor receives no course grade; consequently, an audited course does not count as part of the student's course load for registration purposes, and cannot count as work taken toward completion of residence requirements. A student must be enrolled in at least one other course to be permitted to audit a course.

Fees and Financial Aid

Charges and fees set forth in this bulletin are subject to change without notice.

Tuition and fees vary according to whether or not the student is a legal resident of the state of Rhode Island and according to full-time or part-time enrollment. All charges are payable by the semester and are due and payable upon receipt of the bill or by the due date indicated on the bill.

The Dean of the Graduate School classifies each student admitted to the University as a resident or nonresident student on the basis of all relevant information available to him. Rhode Island residents must file with the Graduate School a certificate of residence signed by the Clerk of the Rhode Island city or town where they claim legal residence. A student may appeal the decision to the Board of Residence Review.

New England Regional Student Program. Under the provisions of the New England Regional Student Program for graduate students administered by the New England Board of Higher Education, the University charges a regional student rate (125% of Rhode Island resident tuition) to residents of another New England state who are matriculated graduate students in certain programs. The student must apply through the Graduate School and the specific program must be one which is *not available* at the student's home-state university. Normally, these programs are listed in the New England Regional Student Program graduate level booklet. In cases where an apparently similar program of study is available at both institutions involved, residents of another New England state must obtain certification from the dean of the Graduate School of their home-state university that the program of study is not available there. This certification will normally take the form of a statement by the chairperson of the relevant department endorsed by the graduate dean. Inquiries and requests for further information may be directed to the Dean of the Graduate School at the University of Rhode Island or to the New England Board of Higher Education, Wenham, Massachusetts 01984.

Rhode Island Inter-Institutional Exchange. Any full-time student matriculated at one of the public institutions of higher education in Rhode Island may enroll for a maximum of 7 credit hours of his/her full-time schedule per semester for study at one of the other public institutions at no additional expense. Each institution will determine and maintain the integrity of the degree to be awarded. Students will be subject to the course selection process applicable at the receiving institution. Summer session and continuing education registrants are not covered under this program. Students interested in this arrangement should contact the Registrar's Office.

Tuition Waiver for Senior Citizens at Public Institutions of Higher Education. Any Rhode Island resident senior citizen who submits evidence of being 60 years of age, or over, will be allowed to take courses at any public institution of higher education in the state with the tuition waived. Admission into particular courses will be granted upon a space-available basis and is at the discretion of the receiving institution. All other costs of attendance are to be borne by the student.

Schedule of Fees. This schedule of fees is effective for the 1982-83 academic year. The University reserves the right to revise its schedule of tuition and fees without notice.

Full-time, One Academic Year

Students registered for 9 or more credits, graduate research assistants and graduate assistants are considered full-time and are charged the following fees:

Tuition	
Rhode Island residents	$1,175.00
Regional students	1,469.00
Out-of state residents	2,749.00
Registration fee	20.00
Graduate student assessment	8.00
Memorial Union fee	97.00
Health Services fee	136.00
Medical Insurance fee	49.50

Health Service Fees

All full-time graduate students, all graduate research assistants, all

graduate assistants, and all international students are required to participate in the University Health Services plan and accompanying Medical Insurance plan. The Medical Insurance fee may be waived if evidence of comparable coverage in another plan is provided and the student completes, signs, and returns a waiver card to the Bursar's Office by the announced term bill due date. Part-time students and spouses of students are eligible to participate in the health and insurance plan on an optional basis.

Part-time, One Semester

Students registered for 8 credits or less are charged the fees below. Residents maintaining continuous enrollment and registered for no credit (CRG 999) are required to pay a fee of $70 per semester; regional students pay $88; non-residents pay $154 per semester.

Tuition, per credit hour	
Rhode Island residents	$70.00
Regional students	88.00
Out-of-state residents	154.00
Registration fee	10.00
Graduate student assessment	1.00
Memorial Union fee, 5-8 credits	12.25
1 to 4 credits	6.00

Application Fee. Fifteen dollars ($15) must accompany each application for admission. See page 14 for application procedure.

Additional Fees. Students may be asked to make key deposits and to cover laboratory and other incidental expenses for specific courses. Students taking performance courses in music are charged an additional applied music fee each semester of $60 for 0 credit, $80 for 2 credits, and $120 for 3, 4, and 6 credits.

Master's degree candidates must pay a thesis-binding fee of $4 and doctoral candidates must pay a dissertation-binding and microfilming fee of $30. These fees are due before candidates submit their dissertations for approval by the Graduate School. All degree candidates must pay a diploma fee of $10.

Late Fees. A late registration fee of $15 for the first week during which registration falls, and $50 thereafter, is charged unless excused by the Registrar.

Reassessment of Fees. Students are allowed to drop and add credits during the first two weeks of each semester (add period). Fees are reassessed and adjusted according to the credit enrollment and/or student status resulting from drop/add transactions as processed by the Registrar during the add period.

Subsequent to the add period, term bills are only reassessed for part-time students who add credits. The dropping of credits after the add period does not reduce term bills.

Remission of Fees. Remission of tuition and the registration fee is granted to holders of tuition scholarships, graduate assistantships (12 credits per semester), and most fellowships. This policy does not include graduate research assistants and associates whose stipends are normally larger than those of graduate assistants. The health services and medical insurance fees and the graduate student assessment are excluded from this remission policy.

Refunds. Refunds of payments made or credits against amounts due to the University shall be made to students who *officially withdraw* from the University according to the following scale: first two weeks, 80%; third week, 60%; fourth week, 40%; fifth week, 20%; after five weeks, no refund. The attendance period in which withdrawal occurs is counted from the first day of registration and includes weekends and holidays.

Financial Aid

There are several forms of financial assistance available to graduate students. To be eligible for any form of assistance, the student must first be admitted to the Graduate School. Detailed information (stipends, allowances, tenure, etc.) on the fellowships, scholarships, and assistantships described below is available from the Graduate School Office and is included in the *Graduate Student Manual.* Fellowships and scholarships are awarded by the Dean of the Graduate School to students selected from nominees submitted by department chairpersons. Students are advised to request nomination for these awards by the chairperson of the department in which they plan to study or are currently enrolled at the University.

Fellowships. Fellowships are awarded to graduate students in recognition of achievement and promise as scholars. They are intended to enable students to pursue graduate studies and research without rendering any service to the University. A fellow's stipend is not considered compensation, but a gift. Graduate fellows are required to be full-time students and may not engage in additional remunerative work without the specific advance approval of the Dean of the Graduate School.

Special Fellowships are supported by various industrial firms, private foundations, and individuals, and are usually restricted to students in particular areas of study and research. The stipends and supplemental allowances of these fellowships are not uniform.

A limited number of *University of Rhode Island Graduate Fellowships* is awarded each year to promising students in doctoral programs. URI Fellows receive a stipend of $4,700 for the academic year and have tuition remitted by the University. Those wishing to be considered for fellowships should have their applications completed by February 1.

Graduate Assistantships and Graduate Research Assistantships. Assistantships are awarded to full-time graduate students to provide them with teaching and research training. Assistants may be required to provide service for up to 20 hours per week. Appointments are initiated by department chairpersons. To be eligible for such an appointment, students must first be admitted to the Graduate School. Their applications for the assistantships should be submitted to the department chairperson by February 15. Appointments are announced about April 1.

Graduate Assistants assist, under supervision, with instructional and/or research activities of a department. Not more than ten hours per week will be in classroom contact. Graduate assistant stipends for the 1982-83 academic year range from $4,700 to $5,500, depending upon qualifications. In addition, tuition and registration fees are remitted for 12 credits in each semester of the academic year of the appointment. Additional remuneration is given for any work done during the summer, although such work cannot be guaranteed.

Graduate Research Assistants are assigned to individual research projects sponsored either by the University or by an outside agency. On supported research contracts and grants, the graduate research assistants are judged to be employed on a half-time basis (based on a 40-hour week). For this they normally receive a stipend ranging from $4,700 to $5,500 for nine months. In addition, tuition and registration fees are remitted for 12 credits in each semester of the academic year of the appointment. Additional remuneration is given for any work done during the summer months.

Other Assistance. *Tuition scholarships,* which provide for the remission of tuition and registration fees, are awarded by the Dean of the Graduate School from University funds. These scholarships are awarded to qualified students demonstrating need of financial assistance. Application forms are available in the Graduate School Office.

Loans are available for qualified students. For information contact the Student Financial Aid Office in Roosevelt Hall, which administers them.

Veterans' benefits information may be obtained from the Veterans' Liaison Officer in the Registrar's Office. All students receiving veterans' benefits are required to report to the Veterans' Liaison Office upon withdrawing from or dropping any course, or upon withdrawal from the University. Failure to do so will result in the termination of veterans' benefits.

Graduate Programs

Course Codes

ACC - Accounting
ADE - Adult and Extension Education
AAF - African and Afro-American Studies
AVS - Animal and Veterinary Science
APG - Anthropology
AMS - Applied Mathematical Sciences
ASP - Aquacultural Science and Pathology
ART - Art
AST - Astronomy
BCP - Biochemistry and Biophysics
BOT - Botany
BED - Business Education
BSL - Business Law
CHE - Chemical Engineering
CHM - Chemistry
CVE - Civil and Environmental Engineering
CMD - Communicative Disorders
CPL - Community Planning
CLS - Comparative Literature Studies
CSC - Computer Science
CNS - Consumer Studies
DHY - Dental Hygiene
ECN - Economics
EDC - Education
ELE - Electrical Engineering
ENG - English
EHS - Environmental Health Science
EST - Experimental Statistics
FIN - Finance
FMT - Fisheries and Marine Technology
FSN - Food Science and Technology, Nutrition and Dietetics
FOR - Forest and Wildlife Management
FRN - French
GMA - Geography and Marine Affairs
GEL - Geology
GER - German
GRK - Greek
HIS - History
HED - Home Economics Education
HCF - Human Development, Counseling, and Family Studies
IDE - Industrial Engineering
INS - Insurance
ITL - Italian
JOR - Journalism
LAT - Latin
LSC - Library Science
LIN - Linguistics
MGT - Management
MGS - Management Science
MKT - Marketing
MTH - Mathematics
MCE - Mechanical Engineering and Applied Mechanics
MCH - Medicinal Chemistry
MIC - Microbiology
MUS - Music
NES - New England Studies
NUE - Nuclear Engineering
NUR - Nursing
OCE - Ocean Engineering
OCG - Oceanography
PCG - Pharmacognosy
PCL - Pharmacology and Toxicology
PHC - Pharmacy
PAD - Pharmacy Administration
PHL - Philosophy
PED - Physical Education
PHY - Physics
PLP - Plant Pathology-Entomology
PLS - Plant Science
PSC - Political Science
PSY - Psychology
RCR - Recreation
RDE - Resource Development Education
REN - Resource Economics
REM - Resource Mechanics
RTH - Respiratory Therapy
RUS - Russian
SOC - Sociology
SLS - Soil Science
SPA - Spanish
TXC - Textiles, Clothing, and Related Art
THE - Theatre
URB - Urban Affairs
WRT - Writing
ZOO - Zoology

This section must be read in conjunction with the preceding sections on Degree Requirements and on Admission and Registration. The specific admission and program requirements listed below are included within the general requirements set forth in the preceding sections, and do not reduce those general requirements. For example, scores on the Verbal and Quantitative Aptitude Tests of the Graduate Record Examination (GRE) are required of all applicants unless another nationally-administered test such as Graduate Management Admission Test (GMAT) or the Miller Analogies Test (MAT) is specified below. Scores on the GRE Advanced (subject matter) Tests are required only where specified below.

Please note that the specific program requirements given on the following pages are minimum requirements. For example, additional course credits may be required for individual candidates whose academic background is insufficient.

All graduate-level courses are also described in this chapter. Undergraduate courses numbered at the 400 level, permitted for graduate credit in some cases, are described in the *Undergraduate Catalog* and are listed here for reference only. Courses at the 500 level comprise the majority of coursework between the bachelor's and the master's degrees. Those at the 600 level are advanced graduate courses. The 900-level courses are special types of graduate courses for which no degree credit is given. They include courses offered to remedy deficiencies as well as workshops, institutes, and courses offered one time only by visiting faculty.

Courses with two numbers, e.g. ASP 501, 502 indicate a year's sequence and the first course is either a prerequisite for the second or at least the two cannot be taken in reverse order without special permission. Parentheses after a course number enclose either the old course number or, in cases of multiple listings, the departments and numbers under which the course is also offered.

The roman numeral indicates the semester the course will normally be offered; some courses, however, are offered only in alternate years and a few less frequently. The *Schedule of Courses* issued by the registrar at the November and May registration period must therefore be consulted to determine which courses will be offered in the following semester. The arabic numeral indicates the credit hours; distribution of class hours each week is in parentheses. The instructor's name follows the course description.

The availability of programs of study and areas of specialization set forth in this section, as well as their administrative location, requirements, and titles, are subject to change without notice.

The University experience is designed to provide the successful student with a range of knowledge and skills which can be utilized in a variety of ways after graduation provided that they are combined with appropriate motivation and initiative. Options available to students vary from the traditional liberal education to programs which are heavily professionally oriented. Successful completion of any course of study at the University, however, does not guarantee that the student will find either a specific kind or level of employment.

Students who are interested in the career opportunities related to particular programs of study are encouraged to discuss their interests with the appropriate department chairperson or director of graduate studies as listed in this bulletin, with the deans of the Graduate School, and/or with the staff of the Office of Career Services. Students who are uncertain about their career choice are invited to inquire about the services offered by the Counseling Center.

Accounting

M.S.

Graduate Faculty

Chairperson: Professor Richard Vangermeersch, Ph.D., 1970, University of Florida; C.P.A. (Rhode Island)
Professor Spencer J. Martin, Ph.D., 1970, University of Illinois; C.P.A.
Associate Professor Joseph P. Matoney, Jr., Ph.D., 1973, Pennsylvania State University; C.P.A. (Rhode Island)
Associate Professor Henry R. Schwarzbach, D.B.A., 1976, University of Colorado; C.P.A.
Assistant Professor Scott N. Cairns, M.S., 1973, Pennsylvania State University; C.P.A.
Assistant Professor Charles T. Hamilton, M.S., 1973, University of Illinois; C.P.A. (Illinois)
Assistant Professor Daniel J. Looney, Jr., J.D., 1971, Suffolk University; C.P.A. (Rhode Island)
Assistant Professor James Rebele, M.B.A., 1979, Indiana University
Assistant Professor E. Kent St. Pierre, Ph.D., 1981, Washington State University; C.P.A. (Illinois)

Master of Science

The program leading to the Master of Science in accounting offers preparation for a variety of fields, including public accounting, business, government, or non-profit organizations. Some graduates enter the teaching field directly, while others decide to continue their education at the doctoral level.

The master's degree program in accounting is designed for students with a variety of educational backgrounds and interests. Those who have graduated with a bachelor's degree in accounting from accredited institutions should be able to complete the program in one year. Those who have received no educational preparation for business or accounting will require two years. Waivers will be given for program requirements successfully completed prior to entry in the program.

Admission requirements: Undergraduate grade point average of approximately B or above and a score at the 50th percentile or above on the GMAT Examination are expected. The GMAT score and the undergraduate quality point average are not the sole criteria for admission. However, those with undergraduate quality point averages of less than B or with lower than 50th percentile scores on the GMAT have a reduced probability of admission. Applicants for whom English is not the native language will be expected to demonstrate proficiency in written and oral communications (TOEFL score of 575 or above), or they may be required to correct deficiencies by taking selected courses for no program credit.

Program requirements: From 30 to 60 credits, depending upon undergraduate program. A written comprehensive examination is required, and a thesis option is available.

Master of Business Administration

See Business Administration program, page 26.

All 500- and 600-level courses offered by the departments in the College of Business Administration are open to matriculated graduate students only.

ACC Courses
Accounting

413 Contemporary Accounting Issues *(I, 3)*
415 Accounting-Computer Systems *(I, 3)*
422 Advanced Cost Accounting *(II, 3)*
431 Advanced Accounting *(II, 3)*
443 Federal Tax Accounting *(I, 3)*
461 Auditing *(II, 3)*

510 Financial Accounting *(I and II, 3)* Concepts of financial accounting in the analysis and interpretation of financial statements; emphasis on accounting principles. *(Lec. 3)* Staff

513 Accounting Systems *(I, 3)* Principles and problems related to design and installation of accounting control systems with emphasis on automated data processing. *(Lec. 3) Pre: 312 or permission of department.* Staff

535 Advanced Problems in Accounting *(II, 3)* General and specialized accounting problems that constitute the subject matter of CPA examinations. *(Lec. 3) Pre: 431.* Staff

544 Topics in Federal Taxation *(II, 3)* Special topics in areas of partnerships, corporations, trusts and estates. *(Lec. 3) Pre: 443 and permission of department.* Staff

548 Accounting for Non-Commercial Entities *(II, 3)* Principles and practices of fund accounting as applied to municipalities, educational institutions, hospitals, and similar organizations, with particular emphasis upon municipal records and statements. *(Lec. 3) Pre: permission of instructor.* Staff

610 Financial Accounting *(I and II, 4)* Covers basic accounting principles, accounting systems design, and financial statement analysis. Includes principles of responsibility accounting and budgeting. *(Lec. 4) Pre: mathematics or statistics, ECN 590 or permission of instructor.* Staff

611 Managerial Accounting *(I and II, 3)* Determination of accounting information for the purposes of decision-making, control, and evaluation with emphasis on decision models using accounting information. *(Lec. 3) Pre: 510, MGS 580, 581 or equivalent.* Staff

618 Current Accounting Theory *(I, 3)* Critical examination of accounting theory and practice to develop research techniques with emphasis on financial accounting. *(Lec. 3) Pre: 311, 312, 510.* Staff

619 Current Accounting Theory *(II, 3)* Critical examination of accounting theory and practice with respect to cost and managerial accounting. *(Lec. 3) Pre: 321 or 611.* Staff

641 Federal Taxation Seminar *(II, 3)* Examination and discussion of the laws and rationale affecting the federal taxation of individuals as well as an introduction to research in taxation. *(Lec. 3) Pre: 311 and enrollment in the MS program in accounting.* Cairns and Matoney

643 Federal Taxes and Business Decisions *(II, 3)* The course focuses on tax law and its effect on business decisions. Cases are employed and primary emphasis is on income tax planning although estate and gift taxes are explored. *Pre: 510.* Staff

661 Seminar in Auditing *(I, 3)* Readings and discussions on auditing standards, procedures, programs, working papers, internal control, and current auditing topics. *(Lec. 3) Pre: 311 and enrollment in the MS program in accounting.* St. Pierre

662 Advanced Auditing *(II, 3)* Statements on auditing standards, auditing electronic systems, auditor's reports, statistical sampling in auditing, regulations of SEC, and cases in auditing. *(Lec. 3) Pre: 461, MGS 581.* Staff

681 Accounting Policy *(II, 3)* Development of accounting policy with respect to managerial planning and control. Emphasis on analytical evaluation of cases with major research project. *(Lec. 3) Pre: 618, graduate standing and completion of all foundation courses.* Staff

691, 692 Directed Study in Accounting *(I and II, 1-3)* Advanced work under the supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. 1-3) Pre: permission of instructor.* Staff

Animal Pathology

M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor Thomas L. Meade, Ph.D., 1953, University of Florida
Professor Pei Wen Chang, Ph.D., 1965, Yale University
Professor Wayne K. Durfee, Ph.D., 1963, Rutgers—The State University
Professor Lewis T. Smith, Ph.D., 1962, Iowa State University
Professor Richard E. Wolke, Ph.D., 1968, University of Connecticut
Professor Vance J. Yates, Ph.D., 1960, University of Wisconsin
Associate Professor Conrad W. Recksiek, Ph.D., 1972, University of Maine
Adjunct Associate Professor John Gentile, Ph.D., 1966, University of New Hampshire
Adjunct Professor Alexander H. Walsh, Ph.D., 1972, University of Wisconsin

Specializations

Animal virology, aquaculture, and marine pathology with specialization in the characterization of avian viral infections; recovery of viruses from inland estuaries, streams and ponds; fish physiology, nutrition, and genetics; ichthyopathology; invertebrate pathology; and the effects of environmental pollution on marine organisms.

Master of Science

Admission requirements: GRE and an undergraduate major in biological sciences with a concentration in animal science, marine biology, microbiology or zoology; one year of organic chemistry and physics. Courses in statistics, histology and physiology are strongly recommended.

Program requirements: animal virology option: thesis and ASP 501, 502, 534, 536; BCP 581, 582; MIC 432, 533.

Aquaculture option: thesis and coursework selected in consultation with the major professor and department chairperson.

Marine pathology option: thesis and ASP 501, 502, 534, 536, 555, 556; EST 408; suggested courses: ASP 483, 584.

Doctor of Philosophy (Biological Sciences)

Admission requirements: same as for master's degree; Ph.D. qualifying examination.

Program requirements: animal virology option: courses listed under M.S. degree and ASP 538; MIC 552, 641; suggested courses: BCP 622, 624.

Marine pathology option: courses listed under M.S. degree and BCP 581, 582; MIC 533; ZOO 512; suggested courses: BCP 622, 624; OCG 509, 568.

ASP Courses
Aquacultural Science and Pathology

401 Introduction to Pathology *(I or II, 3)*
452 (or FMT 452) Industrial Fishery Technology *(I, 3)*
461 (or AVS 461) Laboratory Animal Technology *(I, 3)*
474 Population Genetics in Animal Breeding *(II, 3)*
476 The Genetics of Fish *(II, 2)*
483 Salmonid Aquaculture *(I, 3)*
491, 492 Special Projects *(I and II, 3 each)*

501, 502 Seminar *(I and II, 1 each)* Preparation and presentation of scientific papers on selected subjects in animal pathology and virology. Staff

532 Experimental Design
See Experimental Statistics 532.

534 Animal Virology *(II, 3)* Basic properties, classification and evolution of animal viruses. Individual agents are studied in detail. *(Lec. 3) Pre: MIC 432, 533 and permission of department.* Yates and Chang

536 Virology Laboratory *(II, 2)* Methods employed in diagnosis and for the investigation of the biological, physical, and chemical properties of animal viruses. *(Lab. 6) Pre: 534. (May be taken simultaneously.)* Chang

538 Epidemiology of Viral and Rickettsial Diseases *(II, 2)* Principles of epidemiology. Interrelationships of host, environment, and agent in viral and rickettsial diseases. *(Lec. 2) Pre: 534. (May be taken simultaneously.) In alternate years, next offered 1982-83.* Chang

555, 556 Pathology Rotation *(I, II, 3)* Applied anatomical and clinical pathology of aquatic animals including necropsy duty and/or clinical hematology, chemistry, microbiology, parasitology. Attendance at weekly histopathology seminar and research/case report required. *(Lab. 6) Pre: a course in histology or ZOO 323, MIC 432 and/or permission of instructor.* Wolke

584 Advanced Aquaculture Systems *(II, 3)* Development of design criteria, operational analysis, and management of selected species in water re-use systems. *(Lec. 2, Lab. 2) Pre: MIC 361 or equivalent or permission of instructor. In alternate years, next offered 1983-84.* Meade

586 Fish Nutrition *(I, 3)* Digestion and metabolism of carbohydrate, protein, and lipids by fish. Role of vitamins and minerals in metabolism and associative nutritional diseases resulting from deficiencies. Inadvertent toxic factors in fish feeds. *(Lec. 3) Pre: 412 and CHM 228 or equivalent. In alternate years, next offered 1983-84.* Meade

591, 592 Special Projects *(I and II, 1-3 each)* Research projects in animal pathology, virology, and aquaculture. *Pre: permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Animal Science

M.S.

Graduate Faculty

Chairperson: Associate Professor H. Glenn Gray, Ph.D., 1966, Cornell University
Professor Pei Wen Chang, Ph.D., 1965, Yale University
Professor Gerald A. Donovan, Ph.D., 1955, Iowa State University
Professor Vance J. Yates, Ph.D., 1960, University of Wisconsin
Associate Professor Francis C. Golet, Ph.D., 1973, University of Massachusetts
Associate Professor Walter P. Gould, Ph.D., 1966, Syracuse University
Associate Professor Murn M. Nippo, Ph.D., 1976, University of Rhode Island
Assistant Professor Thomas P. Husband, Ph.D., 1977, Michigan State University

Specializations

Animal and veterinary science faculty specializations include animal physiology, endocrinology, nutrition, behavior, and health. The most active areas of departmental research are directed toward laboratory animal programs. A joint program is offered with the Department of Forest and Wildlife Management in habitat management, wildlife management, and game bird nutrition and propagation.

Interdisciplinary programs with other departments may be designed to meet specific student interests. Research is a cooperative effort supported by the Rhode Island Agricultural Experiment Station and private granting agencies. Research laboratories and animal facilities are maintained in the Animal and Veterinary Science Center at Peckham Farm.

Master of Science

Admission requirements: GRE. A bachelor's degree in agriculture or biological science is preferred with a concentration in animal science, wildlife management, biology, zoology, or allied fields. A background in animal physiology, nutrition, genetics, and/or health is desirable.

Program requirements: animal-related research, thesis, and oral defense of thesis. A minimum of 24 coursework credits (exclusive of a minimum of 6 thesis credits) are required and are determined by student interests and background with the approval of the major professor. Enrollment in one semester of graduate seminar is required and attendance at departmental seminar is mandatory.

AVS Courses
Animal and Veterinary Science

412 Animal Nutrition *(II, 3)*
415 Physiology of Lactation *(I, 3)*
432 Biology of the Fowl *(II, 3)*
451 Horse Nutrition and Feeding *(II, 3)*
462 Laboratory Animal Techniques *(II, 3)*
463 Animal Veterinary Technology *(II, 3)*
472 Physiology of Reproduction *(II, 3)*
474 Population Genetics in Animal Breeding *(II, 3)*
491, 492 Special Projects *(I and II, 1 each)*

501, 502 Graduate Seminar *(I and II, 1)* Preparation and presentation of papers on scientific topics based on research investigations or literature surveys of selected subjects in animal and veterinary science. *(Lec. 1) Pre: graduate standing.* Staff

512 Advanced Animal Nutrition *(II, 3)* Digestion and metabolism of protein, carbohydrate, and fat by ruminant and nonruminant animals. Role of vitamins and minerals in metabolism. Experimental methods in animal nutrition. Emphasis on the ruminant animal. *(Lec. 2, Lab. 2) Pre: 412, CHM 124 or BCP 581 and permission of department. In alternate years, next offered 1983-84.* Staff

580 Experimental Animal Techniques
See Electrical Engineering 580.

591, 592 Research Problems *(I and II, 3 each)* Research problems to meet individual needs of graduate and honors students in the field of animal breeding, nutrition, or physiology and food science. *(Lab. 6, TBA) Pre: permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Applied Mathematical Sciences

Ph.D. (Interdepartmental)

This interdepartmental program is sponsored by the Departments of Computer Science and Experimental Statistics, Industrial Engineering, Management Science, and Mathematics. It is administered by a coordinating committee selected from the Graduate Faculty.

Graduate Faculty

Professor Edward J. Carney, Ph.D., 1967, Iowa State University
Professor Rodney D. Driver, Ph.D., 1960, University of Minnesota
Professor Charles F. James, Jr., Ph.D., 1963, Purdue University

Professor Jeffrey E. Jarrett, Ph.D., 1967, New York University
Professor Russell C. Koza, Ph.D., 1968, Rensselaer Polytechnic Institute
Professor Gerasimos Ladas, Ph.D., 1968, New York University
Professor James T. Lewis, Ph.D., 1969, Brown University
Professor Pan-Tai Liu, Ph.D., 1968, State University of New York, Stony Brook
Professor Dennis W. McLeavey, D.B.A., 1972, Indiana University; C.P.I.M. (Fellow)
Professor Peter F. Merenda, Ph.D., 1957, University of Wisconsin
Professor Richard Mojena, Ph.D., 1971, University of Cincinnati
Professor D. Edward Nichols, Ph.D., 1958, Purdue University
Professor John S. Papadakis, Ph.D., 1971, Polytechnic Institute of Brooklyn
Professor Alexander D. Poularikas, Ph.D., 1965, University of Arkansas
Professor Warren F. Rogers, Ph.D., 1971, Stanford University
Professor Emilio O. Roxin, Ph.D., 1959, University of Buenos Aires
Professor Oved Shisha, Ph.D., 1958, Hebrew University
Professor Robert C. Sine, Ph.D., 1962, University of Illinois
Professor Lewis T. Smith, Ph.D., 1962, Iowa State University
Professor E. Ramnath Suryanarayan, Ph.D., 1961, University of Michigan
Professor Donald W. Tufts, Sc.D., 1960, Massachusetts Institute of Technology
Professor Ghasi Ram Verma, Ph.D., 1957, Rajasthan University
Associate Professor Leonard J. Bass, Ph.D., 1970, Purdue University
Associate Professor Frank M. Carrano, Ph.D., 1969, Syracuse University
Associate Professor Norman J. Finizio, Ph.D., 1972, Courant Institute of Mathematical Sciences, New York University
Associate Professor R. Choudary Hanumara, Ph.D., 1968, Florida State University
Associate Professor James F. Heltshe, Ph.D., 1973, Kansas State University
Associate Professor Edmund A. Lamagna, Ph.D., 1975, Brown University
Associate Professor William D. Lawing, Jr., Ph.D., 1965, Iowa State University
Associate Professor Seetharama Narasimhan, Ph.D., 1973, Ohio State University
Associate Professor Lewis J. Pakula, Ph.D., 1972, Massachusetts Institute of Technology
Associate Professor David M. Shao, Ph.D., 1970, State University of New York, Buffalo
Associate Professor Nelson H. Weiderman, Ph.D., 1971, Cornell University
Assistant Professor Lester W. Garber, Ph.D., 1979, Pennsylvania State University
Professor Emeritus William J. Hemmerle, Ph.D., 1963, Iowa State University
Adjunct Assistant Professor David Wood, Ph.D., 1972, University of Rhode Island

Specializations

Applied mathematics, computer science, operations research, statistics, and applied probability.

Doctor of Philosophy

Admission requirements: GRE with advanced test in undergraduate field, bachelor's degree in computer science, engieering, mathematics, management science, physical sciences, statistics, or equivalent. With permission, GMAT may be substituted for GRE by applicants with business background. Applicants with entrance deficiencies may be accepted subject to taking certain undergraduate courses in addition to the graduate program requirements. Although a person with a bachelor's degree may be admitted, this program is designed principally for people who have a master's degree. Special efforts are made to accommodate people who are employed on a full-time basis.

Program requirements: dissertation, 54 course credits beyond the bachelor's degree including MTH 437, 438, two courses selected from MTH 462, 513, 515, 535, 545, 561, and 641, and three core courses in each of two of the following areas: applied mathematics, basic analysis, numerical analysis, computer science, operations research, statistics, and applied probability. (A maximum of 30 credits may be granted for a master's degree in a related area.) Comprehensive examination in core areas and reading proficiency in one foreign language. The Ph.D. qualifying examination is required of students admitted without the master's degree.

AMS Courses
Applied Mathematical Sciences

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Audiology

M.A., M.S.

See Speech-Language Pathology on p. 92.

Biochemistry and Biophysics

M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor Harold W. Fisher, Ph.D., 1959, University of Colorado
Professor Robert G. Bell, Ph.D., 1964, St. Louis University, School of Medicine
Professor Spiros M. Constantinides, Ph.D., 1966, Michigan State University
Professor Joel A. Dain, Ph.D., 1957, Cornell University
Professor Karl A. Hartman, Jr., Ph.D., 1962, Massachusetts Institute of Technology
Professor John L. Purvis, Ph.D., 1956, McGill University
Professor George C. Tremblay, Ph.D., 1965, St. Louis University
Adjunct Professor David J. Morris, Ph.D., 1963, Dyson Perrins Organic Chemistry Laboratory
Adjunct Professor Albert J. Owen, Ph.D., 1974, Harvard University
Adjunct Associate Professor William H. Douglas, Ph.D., 1970, Brown University

Specializations

Vitamin K, anticoagulants and blood clotting, structure and function of enzymes, developmental neurochemistry, mammalian cell culture and tumor viruses, structure and functions of nucleic acid and viruses, electron microscopy and protozoology, nitrogen metabolism in mammalian tissues, structure and function of biological membranes, glyocolipid and glycoprotein metabolism in the nervous system.

Master of Science

Admission requirements: GRE (advanced test in chemistry or biology) and a bachelor's degree in some field of science or engineering including 2 semesters each in organic chemistry with laboratory, biological sciences, and calculus, and 1 semester in physics. Student may be accepted with deficiencies which must be made up without program credit.

Program requirements for all candidates: BCP 435, 521, 581, 582, and 3 credits in a 600-level course exclusive of seminar, special topics, or research. Thesis option: a minimum of 24 credits (exclusive of thesis credits) including the above requirements and a thesis. Non-thesis option: a minimum of 36 credits including the above requirements and BCP 542, 595, 596, and the written master's examination. BCP 542 will require a substantial paper involving significant independent research.

Doctor of Philosophy (Biological Sciences)

Admission requirements: same as for master's degree; M.S. degree not required to enroll in Ph.D. program. Qualifying examination required if admitted without master's degree.

Program requirements: same as listed under master's degree; plus BCP 595, 596 and at least 6 credits of BCP at the 600 level, exclusive of BCP 699.

BCP Courses
Biochemistry and Biophysics

401 (or MIC 401) Quantitative Cell Culture *(I, 3)*
403 (or MIC 403) Introduction to Electron Microscopy *(I, 2)*
405 (or MIC 405) Electron Microscopy Laboratory *(I, 2)*
411 Biochemistry Laboratory *(II, 3)*
435 Physical Chemistry for Life Sciences *(I, 3)*
491, 492 Research in Biochemistry and Biophysics *(I and II, 1-6)*

521 Introductory Biophysics *(II, 3)* Use of viscosity, diffusion, ultracentrifugation, light scattering, spectrophotometry, and X-ray diffraction to study the size, shape, structure, and molecular weight of biological macromolecules. *(Lec. 3) Pre: permission of instructor.* Hartman

523, 524 Special Topics in Biochemistry and Biophysics *(I, II, 1-6 each)* Advanced work arranged to suit the individual needs of the student. Lecture and/or laboratory according to the nature of the problem. Credits not to exceed a total of 12. *Pre: permission of department.* Staff

541, 542 Laboratory Techniques in Biochemistry *(I, II, 3 each)* Biochemical techniques of enzyme preparation and purification, cell fractionation, ion-exchange and paper chromatography, manometry, fluorometry, polarography, radioactive tracer. Assigned research on advanced level using techniques. *(Lab. 9) Pre: permission of department.* Staff

581, 582 General Biochemistry *(I, II, 3 each)* Systematic treatment of the principles of biochemistry. Basic course dealing with chemistry of biological substances and transformations in living organisms. *(Lec. 3) Pre: CHM 228, 229.* Staff

595, 596 Seminar in Biochemistry and Biophysics *(I, II, 1 each)* Presentation of papers on selected subjects in biophysics. *(Lec. 1)* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

601 Enzymes *(I, 3)* Factors affecting the rate of catalysis in enzymic reactions. Thermodynamic and kinetic characteristic of enzymes' profiles. *(Lec. 1½, Lab. 8) Pre: 581, 582, and/or permission of department. In alternate years, next offered 1983-84.* Dain

611 Metabolism *(I, 3)* Intensive study of metabolic pathways of carbohydrates, lipids, and nitrogenous compounds, their interrelationships. Effects of hormonal and nutritional status on activity of these pathways. *(Lec. 3) Pre: 581, 582, and/or permission of department. In alternate years.* Dain and Bell

612 Biochemical Regulation of Cellular Metabolism *(II, 3)* Biochemical regulatory mechanisms of cellular metabolism in microorganisms and mammalian systems, at the level of the genome, protein synthesis, and enzyme catalysis. *(Lec. 3) Pre: 581, 582, and/or permission of department. In alternate years.* Tremblay and Bell

622 Advanced Electron Microscopy
See Microbiology 622.

624 Advanced Electron Microscopy Laboratory
See Microbiology 624.

651, 652 Research in Biochemistry and Biophysics *(I, II, 3 each)* Student is required to outline a research problem, conduct necessary literature survey and experimental work and present the observations and conclusions in a report. *(Lab. 6) Pre: graduate standing.* Staff

699 Doctoral Dissertation Research *(I, II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Botany

M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor Roger D. Goos, Ph.D., 1958, University of Iowa
Professor Luke S. Albert, Ph.D., 1958, Rutgers — The State University
Professor Carl H. Beckman, Ph.D., 1953, University of Wisconsin
Professor Richard L. Hauke, Ph.D., 1960, University of Michigan
Professor Elmer A. Palmatier, Ph.D., 1943 Cornell University
Professor Theodore J. Smayda, Dr. Philos., 1967, University of Oslo
Professor Elijah Swift V., Ph.D., 1967, The John Hopkins University
Associate Professor Paul E. Hargraves, Ph.D., 1968, College of William and Mary
Associate Professor Marilyn Harlin, Ph.D., 1971, University of Washington
Associate Professor John P. Mottinger, Ph.D., 1968, Indiana University
Associate Professor Robert G. Sheath, Ph.D., 1977, University of Toronto
Assistant Professor Keith T. Killingbeck, Ph.D., 1976, University of North Dakota
Assistant Professor Richard E. Koske, Ph.D., 1971, University of British Columbia
Assistant Professor Elizabeth Swanson, Ph.D., 1971, University of California, Riverside
Adjunct Professor Donald K. Dougall, Ph.D., 1956, University of Oxford
Professor Emeritus Nestor E. Caroselli, Ph.D., 1954, Brown University
Professor Emeritus Robert Lepper, Jr., Ph.D., 1954, University of Connecticut

Specializations

Aquatic botany (marine and freshwater), cell biology, genetics and cytogenetics, mycology, phycology, plant development, plant ecology, plant physiology, plant taxonomy (M.S. only), plant ultrastructure.

Master of Science

Admission requirements: GRE including advanced test and undergraduate major in the sciences. Candidates lacking undergraduate courses in organic chemistry, physics, mathematics through introductory calculus, and fundamental courses in biological sciences may be required to make up deficiencies without graduate credit.

Applicants are normally admitted for September only. Deadline for receipt of applications and all supporting documents is February 15.

Program requirements: thesis and BOT 581, 582.

Doctor of Philosophy (Biological Sciences)

Admission requirements: same as for master's degree, which is normally required. Oral diagnostic proficiency examination required during the first semester for those accepted with the master's degree. Qualifying examination required for those accepted without the master's degree.

Program requirements: dissertation, one foreign language (to be passed before taking comprehensive examination); BOT 581, 582. Comprehensive examination will require competency in major areas of botany.

BOT Courses
Botany

418 Marine Botany *(II, 3)*
419 Freshwater Botany *(I, 3)*
424 Plant Ecology *(II, 3)*
426 Plant Geography *(II, 3)*
432 Mycology: Introduction to the Fungi *(I, 4)*
433 Field Mycology *(SS, 3)*
445 Advanced Plant Physiology *(II, 3)*
453 (or MIC 453) Cell Biology *(II, 3)*
454 Advanced Genetics Laboratory *(I, 3)*
455 (or ZOO 455) Marine Ecology *(I, 3)*
457 (or ZOO 457) Marine Ecology Laboratory *I, 1)*
490 Modern Techniques in Botanical Sciences *(I and II, 2)*

511 Developmental Plant Anatomy *(I, 3)* Ontogeny of plant structures is studies from zygote through seed production with emphasis on recent experimental studies which elucidate the morphogenic mechanisms. Ecological anatomy is included. *(Lec. 2, Lab. 3) Pre: 311 or equivalent. In alternate years, next offered 1982-83.* Hauke

512 Morphology of Vascular Plants *(I, 3)* Comparative survey of development, form, and anatomy of extinct and extant vascular plants and modern interpretation of evidence concerning their interrelationships. *(Lec. 2, Lab. 2) Pre: 311 or equivalent. In alternate years.* Hauke

521 Recent Advances in Cell Biology See Microbiology 521.

524 Methods in Plant Ecology *(II, 3)* Methods in analysis of vegetation and microenvironments. Emphasis on quantitative techniques in analysis of vegetation, soil, and microclimate; techniques in physiological ecology. *(Lec. 2, Lab. 3) Pre: 111 and 424 or equivalent; EST 412 desirable. In alternate years, next offered 1983-84.* Killingbeck

534 Physiology of the Fungi *(I, 3)* Life processes of fungi with particular emphasis on chemical composition, organic and mineral nutrition, toxic and stimulating agencies, and metabolism. Also stresses phenomena of variation of growth and sporulation as affected by various environmental factors. *(Lec. 2, Lab. 2) Pre: 432, or permission of department. In alternate years, next offered 1982-83.* Koske

538 Ecology of Fungi *(I, 3)* Interactions of fungi with plants, animals, and the environment, with emphasis on the role of fungi in the ecosystem. Individual project required. *(Lec. 1, Lab. 4) Pre: 432 or permission of instructor. In alternate years, next offered 1983-84.* Koske

540 Experimental Mycology *(II, 3)* Growth and reproduction of fungi as affected by nutritional, environmental, and genetic factors, with emphasis on experimental methods. *(Lec. 1, Lab. 4) Pre: 432 and MIC 201 or 211 or permission of instructor. In alternate years, next offered 1983-84.* Goos

542 Medical Mycology *(II, 3)* Fungi pathogenic for humans and animals. *(Lec. 1, Lab. 4) Pre: 432 or MIC 201 or 211 or permission of instructor. In alternate years, next offered 1982-83.* Goos

551 Seminar in Aquatic Botany *(I, 1)* Readings and discussion on current research involving algae and other aquatic plants. *(Lec. 1) May be repeated. Pre: permission of instructor.* Harlin, Sheath

554 Cytogenetics *(I, 4)* Comparisons of various types of crossing-over, chromosomal aberrations and their effects, mutation, and other cytogenetic phenomena in fungi and higher organisms. Laboratory studies of meiosis in maize, identification of chromosomes, and induced rearrangements. *(Lec. 2, Lab. 4) Pre: 352, 453, or permission of instructor.* Mottinger

559 Physiological Ecology of Marine Macroalgae *(I, 4)* Comparative studies designed to investigate those environmental factors regulating distribution, physiology, and development of macroalgae through field, laboratory, and library research. *(Lec. 2, Lab. 4) Pre: 418 or equivalent, or permission of instructor. In alternate years, next offered 1983-84.* Harlin

562 Seminar in Plant Ecology *(II, 2)* Recent topics and investigations pertinent to plant ecology. Library research, oral presentation of reports, and group discussions. *(Lec. 2) May be repeated. Pre: 424 or equivalent, and permission of instructor.* Killingbeck

579 Advanced Genetics Seminar See Zoology 579.

581, 582 Botany Seminar *(I and II, 1 each)* Preparation and presentation of papers on subjects in selected areas relating to botany. *(Lec. 1) Pre: required of graduate students majoring in botany. S/U credit.* Staff

591, 592 Botanical Problems *(I and II, 1-3 each)* Special work arranged to meet the needs of individual students who are prepared for and desire advanced work in botany. *(Lec. 1-3, Lab. 2-6) Offered only by arrangement with staff.* Staff

593, 594 Botanical Problems *(I and II, 1-3 each)* Similar to 591, 592, but arranged to meet needs of students desiring further advanced work in botany. *(Lec. 1-3, Lab. 2-5) Offered only by arrangement with staff.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

640 Advanced Mycology Seminar *(I and II, 1 each)* Specialized and advanced treatment of biology and research in the major groups of the fungi, including systematics, physiology, and ecology. *(Lec. 1) May be repeated. Pre: permission of instructor.* Koske

645 Environmental Plant Physiology *(I, 3)* Influence of environmental factors on growth and development at organismic and cellular levels. Explanation of effects through cellular mechanisms. *Pre: 445, BCP 582 or FSN 452 or equivalent, or permission of instructor. In alternate years, next offered 1983-84.* Albert

659 Seminar in Physiological Ecology of Macroalgae *(II, 1)* Readings and discussion of specialized and advanced research, stressing mechanism of environmental adaptation. *(Lec. 1) May be repeated. Pre: 559 or permission of instructor.* Harlin

661 Phytoplankton Taxonomy See Oceanography 661.

663 Phytoplankton Physiology See Oceanography 663.

664 Phytoplankton Ecology See Oceanography 664.

667, 668, 669 Advanced Phytoplankton Seminars See Oceanography 667, 668, 669.

691, 692 Botanical Problems *(I and II, 1-6 each)* Special work to meet needs of individual students who are prepared to undertake special problems. *(Lec. 3 or Lab. 6) Pre: permission of department.* Staff

693, 694 Research in Botany *(I and II, 3 each)* Assigned research, subject matter of which is to be arranged with a member of department and with the approval of the head of the department. *(Lab. 6)* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Business Administration

M.B.A.

Graduate Faculty

Dean, College of Business Administration: Professor Richard R. Weeks, D.B.A., 1966, Washington University

Associate dean and director of M.B.A. program: Professor John Wish, Ph.D., 1967, Michigan State University

Accounting

Chairperson: Professor Richard Vangermeersch, Ph.D., 1970, University of Florida; C.P.A. (Rhode Island)

Professor Spencer J. Martin, Ph.D., 1970, University of Illinois; C.P.A.

Associate Professor Joseph P. Matoney, Jr., Ph.D., 1973, Pennsylvania State University; C.P.A. (Rhode Island)

Associate Professor Henry R. Schwarzbach, D.B.A., 1976, University of Colorado; C.P.A.

Assistant Professor Scott N. Cairns, M.S., 1973, Pennsylvania State University; C.P.A.

Assistant Professor Charles T. Hamilton, M.S., 1973, University of Illinois; C.P.A. (Illinois)

Assistant Professor James Rebele, M.B.A., 1979, Indiana University

Assistant Professor E. Kent St. Pierre, Ph.D., 1981, Washington State University; C.P.A. (Illinois)

Business Law

Associate Professor Richard C. Sisco, J.D., 1964, Georgetown University

Associate Professor Andrew Laviano, J.D., 1965, New York University School of Law

Finance and Insurance

Chairperson: Associate Professor Blair M. Lord, Ph.D., 1975, University of California

Professor Roy G. Poulsen, Ph.D., 1961, Clark University

Associate Professor Gordon H. Dash, Jr., D.B.A., 1978, University of Colorado

Associate Professor John F. Fitzgerald, Jr., Ph.D., 1971, University of Wisconsin; C.L.U., C.P.C.U.

Assistant Professor George Briden, Ph.D., 1982, Brown University

Assistant Professor Severin C. Carlson, D.B.A., 1979, Indiana University
Assistant Professor Rosita P. Chang, Ph.D., 1981, University of Pittsburgh

Management
Chairperson: Professor Craig E. Overton, Ph.D., 1971, University of Massachusetts
Professor Norman Coates, Ph.D., 1967, Cornell University
Professor George deLodzia, Ph.DV, 1969, Syracuse University
Professor Charles T. Schmidt, Jr., Ph.D., 1968, Michigan State University
Associate Professor Dennis W. Callaghan, Ph.D., 1975, University of Massachusetts
Associate Professor Robert A. Comerford, Ph.D., 1976, University of Massachusetts
Assistant Professor Richard W. Scholl, Ph.D., 1980, University of California, Irvine
David Beretta, Chairman of the Board, Uniroyal, Inc. (retired); B.S. 1949, University of Rhode Island; Executive in Residence

Management Science
Chairperson: Professor Dennis W. McLeavey, D.B.A., 1972, Indiana University; C.P.I.M. (Fellow)
Professor Charles P. Armstrong, Ph.D., 1973, University of Arizona
Professor Frank S. Budnick, D.B.A., 1973, University of Maryland
Professor Jeffrey E. Jarrett, Ph.D., 1967, New York University
Professor Chai Kim, Ph.D., 1973, University of Pittsburgh
Professor Russell C. Koza, Ph.D., 1968, Rensselaer Polytechnic Institute
Professor Richard Mojena, Ph.D., 1971, University of Cincinnati
Professor Warren F. Rogers, Ph.D., 1971, Stanford University
Professor Randolph F. C. Shen, Ph.D., 1964, University of Illinois
Associate Professor Roy Ageloff, Ph.D., 1975, University of Massachusetts
Associate Professor Alan B. Humphrey, Ph.D., 1965, North Carolina State University
Associate Professor Seetharama Narasimhan, Ph.D., 1973, Ohio State University
Assistant Professor Paul M. Mangiameli, Ph.D., 1979, Ohio State University

Marketing
Chairperson: Professor Robert W. Nason, Ph.D., 1968, Michigan State University
Professor Aaron J. Alton, Ph.D., 1956, Ohio State University
Professor Albert J. Della Bitta, Ph.D., 1971, University of Massachusetts
Professor Eugene M. Johnson, D.B.A., 1969, Washington University
Professor John Wish, Ph.D., 1967, Michigan State University
Associate Professor Nikhilesh Dholakia, Ph.D., 1975, Northwestern University
Associate Professor Ruby R. Dholakia, Ph.D., 1976, Northwestern University
Assistant Professor Steven J. Lysonski, Ph.D., 1980, Syracuse University
Assistant Professor Daniel Seymour, Ph.D., 1981, University of Oregon

Specializations

Accounting, finance, insurance, management science, marketing, organizational management, international management, health care administration.

Master of Business Administration

The Master of Business Adminstration program is designed for students who desire a broad preparation for executive and administrative positions in business, government, and nonprofit organizations. The program is offered on the Kingston campus for full-time and part-time students, and in the evening through the College of Continuing Education in Providence for part-time students. Candidates may begin the program in June, September, or January of each year. Applications to the Dean of the Graduate School should specify the M.B.A. program and indicate on which campus study is to be undertaken.

Admission requirements: The Graduate Management Admissions Test (GMAT), a statement of purpose, three letters of recommendation, and transcripts of all previous undergraduate or postbaccalaureate work are required. Work experience is valued. Applicants for whom English is not the native language will be expected to score 575 or above on the TOEFL. The GMAT score and undergraduate quality point average are not the sole criteria for admission. However, those with undergraduate quality point averages of less than B or those with less than 50th percentile scores on the GMAT have a low probability of admission.

Program Requirements: The non-thesis program requires a maximum of 58 credit hours. Of these, 7 credit hours are designated "Prerequisite courses" and are necessary to provide the basic tools for successful graduate study in administration: ECN 590, MGS 520, and MGS 530. These courses would ordinarily be waived based on previous college-level study (as approved by the program director in consultation with the departments). The balance of 51 credit hours is composed of 33 credit hours of required courses: ACC 610; BSL 600; FIN 601, 660; MGS 500, 600, 620, 640; MGT 630, 681; MKT 601; plus 18 credit hours of electives. Of the required courses, the following may be waived (upon the recommendation of the appropriate department and the MBA program director, and the approval of the Dean of the Graduate School) based on significant prior college-level study in the appropriate field (usually multiple courses in the field from an AACSB-accredited program): ACC 610; BSL 600; FIN 601; MGS 500, 600, 620, 640; MGT 630; and MKT 601. Of the 18 credit hours of electives, at least 9 hours must be in a single field designated as the "field of concentration."

For students with a B.S.B.A. degree from an AACSB-accredited program, the M.B.A. program of study will comprise a maximum of 12 courses (the "linked" courses MGS 500, 600, and MGS 620, 640 are counted as a total of two courses) and a minimum of 36 credit hours. Ordinarily, this will be achieved through the waiving of sufficient courses and credit hours from the 27 credit hours previously described as waivable (subject to the review process described). For students with a B.S.B.A. from an accredited program not having sufficient required courses and credit hours waived, elective courses will be appropriately reduced (subject to review and approval).

All 500- and 600- level courses offered by departments in the College of Business Administration are open to matriculated graduate students only.

Doctor of Philosophy

The Department of Management Science is a sponsor of the Ph.D. program in Applied Mathematical Sciences (see page 23).

Accounting Courses

See listing under Accounting, page 22.

Business Education Courses

See listing under Business Education, page 30.

BSL Courses
Business Law

442 Property Interest *(II, 3)*
450 Consumer Law Legislation *(I, 3)*

501 Law and Accounting *(I, 3)* Introduction to CPA law exam, question and answer techniques, coverage of most accounting-related legal subjects currently included on CPA exam. *(Lec. 3) Pre: 600 or permission of department.* Sisco

600 (500) Legal Environment of Business *(I and II, 3)* Introduction to legal and court system as it relates to business. Coverage includes both substantive rules and procedural rules of law in the civil and administrative law fields with emphasis on business, regulation, social issues, and ethics. *(Lec. 3) Pre: MGT 530, graduate students only.* Sisco and Laviano

691, 692 Directed Study in Business Law *(I and II, 1-3)* Advanced work under the supervision of a member of the staff and

arranged to suit the individual requirements of the student. *(Lec. 1-3) Pre: permission of instructor.* Staff

FIN Courses
Finance

420 Speculative Markets *(I or II, 3)*
425 Portfolio Theory and Management *(I or II, 3)*
431 Advanced Financial Institutions and Capital Markets *(I or II, 3)*
433 Bank Financial Management *(I, 3)*
442 Real Estate Finance *(I or II, 3)*
452 Multinational Finance *(I, 3)*
460 Managerial Economics *(I or II, 3)*
491, 492 Directed Study *(I and II, 3 each)*

540 Theory of Finance *(I and II, 2)* Uses of financial instruments, problems of capital financing, financial expansion and reorganization, operations of specialized financial institutions. *(Lec. 2) Pre: ACC 510, MGS 580.* Staff

601 Financial Management *(I and II, 4)* Functions and responsibilities of financial managers. Examination of financial issues, both internal to firm and arising from interaction with financial system. Financial statement analysis, structure, valuation, markets, capital budgeting, working capital. *(Lec. 4) Pre: ACC 510 and MGS 520.* Staff

625 Advanced Portfolio Theory and Security Analysis *(I, 3)* An examination of advanced theories and practices in portfolio building and maintenance. Issues related to security price behavior are also examined. *(Lec. 3) Pre: 540 or 601 or equivalent.* Dash

637 (642) Financial System and Markets *(I or II, 3)* An analysis of the effects of the financial system on individual financial markets. Emphasis placed on examination of the behavior of money, stock, bond, and mortgage markets. *(Lec. 3) Pre: permission of instructor. All MBA foundation courses.* Staff

641 Advanced Financial Theory *(I and II, 3)* Role of the financial manager in analysis, profit planning and control activities. Emphasis on goals, basic concepts and tools of decision-making as applied to working capital management, capital budgeting and capital structure decisions. *(Lec. 3) Pre: 540.* Dash

652 Advanced International Financial Management *(I and II, 3)* Analysis of issues relevant to the international financial manager. The financial operations of multinational enterprises are examined through both the theoretical and case approach. *Pre: 540.* Koveos

660 (645) Managerial Economics *(I and II, 3)* The applications of economic theory and methodology to business problems. *(Lec. 3) Pre: all foundation courses.* Staff

671 (649) Seminar in Finance *(I and II, 3)* Independent research. Individual topics based on readings and research interests of the students. *(Lec. 3) Pre: 641.* Staff

685 Health: Financial Management and Insurance
See Management Science 685.

686 Public Policy Issues in the Health System
See Management Science 686.

691, 692 Directed Study in Finance *(I and II, 1-3)* Advanced work under the supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. 1-3) Pre: permission of instructor.* Staff

INS Courses
Insurance

414 (314) Advanced Commercial Property-Liability Insurance *(II, 3)*
433 (333) Social Insurance *(I, 3)*
471 Topics in Insurance *(II, 3)*
491, 492 Directed Study *(I and II, 3)*

510 Risk and Insurance *(I, 3)* Non-speculative business and personal risks and their treatment through insurance. Discussions will include the application of insurance to risks arising from life, health, property, and liability contingencies. *(Lec. 3)* Fitzgerald and Lord

560 Management of Insurance Enterprises *(II, 3)* Functional analysis of the operations and problems of stock and mutual insurance organizations in the life, property, and liability insurance industry. Emphasis is upon legal organization, management and control, and financial management of insurers. *(Lec. 3) Pre: permission of instructor.* Fitzgerald

570 Risk Management *(II, 3)* Analysis of nature of risk, the identification, measurement, and control of pure risk within firm and society. Teaching methodology includes lectures, group discussion, and analysis of case problems. *(Lec. 3) Pre: permission of instructor.* Staff

685 Health: Financial Management and Insurance
See Management Science 685.

686 Public Policy Issues in the Health System
See Management Science 686.

691, 692 Directed Study in Insurance *(I and II, 1-3)* Advanced work under the supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. 1-3) Pre: permission of instructor.* Staff

MGT Courses
Management

407 Organization and Management Theory *(I and II, 3)*
408 Organization Development and Change *(I or II, 3)*
410 Business Policy *(I and II, 3)*
422 Labor Law and Legislation *(II, 3)*
423 Labor Relations *(II, 3)*
431 Advanced Management Seminar *(I or II, 3)*
480 Small Business Management *(I and II, 3)*
491, 492 Special Problems *(I and II, 3 each)*

530 Management Theory and Practice *(I and II, 2)* Management applied to business; objectives, policies, organization staffing, and control; production; personnel; behavioral science applications; the role of quantitative methods. *(Lec. 2)* Staff

626 Organizational Behavior *(I and II, 3)* Incorporates the insights gleaned from the disciplines of psychology, sociology, anthropology, and the social sciences of politics, economics, and history in the study of the behavior of organizations and of their principal actors. *(Lec. 3) Pre: 530 or equivalent.* Staff

627 Advanced Organization Theory and Behavior *(I and II, 3)* Previous knowledge of classical and traditional management thought used to provide concepts, analytical approaches, and skills for understanding how behavioral sciences influence complex organizational systems. *(Lec. 3) Pre: 626.* Staff

630 Organizational Theory and Behavior *(I and II, 4)* Management applied to business objectives, policies, organizational staffing and control. Interpersonal dynamics in organizational settings. Role of human resource management. Emphasis on individual and structural factors affecting decision-making. *(Lec. 4) Pre: graduate standing.* Staff

636, 639 Seminar in Industrial Management *(I and II, 3 each)* Class discussion of typical cases, original research work in the field of industry with discussion of data collected and analyzed by individual students. *(Lec. 3) Pre: permission of department.* Staff

640 Compensation Administration *(I and II, 3)* Compensation and performance appraisal systems. Theory and techniques used to determine job worth. Special issues in compensation manangement, such as relating pay to performance through appraisal techniques and pay compression. *(Lec. 3) Pre: 630.* Staff

641 Human Resource Development *(I and II, 3)* Techniques used in procurement and development of human resource. Planning through recruitment, selection, and placement to training and development. Integration of HRD process with organizational strategic plans. *(Lec. 3) Pre: 630.* Staff

655 International Business Management *(I, 3)* Examines the problems and characteristics of international management by focusing on the role of the multinational corporation in a cross-cultural setting. *(Lec. 3) Pre: 530 or equivalent.* Staff

670 Business Environmental Analysis *(II, 3)* Advanced analysis of increasingly complex interrelationships between the business organization and its environment. Emphasis on conceptual foundations of business and the impact of contemporary socio-political issues on management decision-making. *(Lec. 3) Pre: 530 or equivalent.* Staff

681 Administrative Policy and Decision Making *(I and II, 3)* Review of the functional areas of marketing, production, finance, economics, accounting, quantitative methods, organizational theory, interpersonal relationships, control and motivation systems, and communications. Includes the M.B.A. written comprehensive examination according to Graduate School requirements. *(Lec. 3) Pre: all M.B.A. foundation courses or undergraduate equivalents and a minimum of 21 M.B.A. credits at the 600 level which must include MKT 601, FIN 641, ACC 610.* Staff

691, 692 Directed Study in Management *(I and II, 1-3)* Advanced work under the supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. 1-3) Pre: permission of instructor.* Staff

MGS Courses
Management Science

445 Managerial Application of Simulation *(I, 3)*
458 Integrated Production-Logistics Systems *(II, 3)*
475 Bayesian Statistics in Business *(I, 3)*
483 Application Programming Using COBOL *(I and II, 3)*
485 Management of Databases *(I, 3)*
486 Management Systems Analysis and Design *(II, 3)*
488 Business Software Development Project *(II, 3)*
491, 492 Special Problems *(I and II, 3 each)*

500 (579) Computing for Management *(I and II, 2)* Computer concepts and programming in a high-level language such as BASIC, FORTRAN, PASCAL. Emphasis on computing as an administrative and analytical tool for applications in management. Includes use of software packages. *(Lec. 2 for one-half semester, 1st half) Graduate credit for non-MBA students only if 600 is completed.* Staff

520 (580) Mathematics for Management *(I, 2)* Fundamental mathematical tools applied to managerial problems. Matrix algebra, differential and integral calculus. *(Lec. 2, for one-half semester, 1st half) Graduate credit for non-MBA students only if 530 is completed.* Staff

530 (581) Statistics for Management *(I, 2)* Fundamental statistical tools applied to managerial problems. Probability distributions, sampling, estimation, tests of hypotheses, regression analysis. *(Lec. 2 for one-half semester, 2nd half) Pre: 520 or equivalent.* Staff

600 Information System Concepts *(I and II, 2)* Concepts, procedures, and managerial issues dealing with information and decision support systems. Topics include hardware and software; business systems; systems analysis, design, and implementation. *(Lec. 2 for one-half semester, 2nd half) Pre: 500 or equivalent.* Staff

601, 602 Advanced Management Statistics *(I and II, 3 each)* Theory and application of regression and correlation analysis, analysis of variance and experimental design, and other multivariate data analyses. *(Lec. 3) Pre: 530 or permission of instructor.* Staff

620 (682) Quantitative Methods for Management *(I and II, 2)* Survey of principal operations research/management science models. Linear programming, network, and other mathematical programming models; simulation, decision analysis, and other probabilistic models. *(Lec. 2 for one-half semester, 1st half) Pre: 500, 520, 530 or equivalent.* Staff

640 (585) Production and Operations Management *(I and II, 2)* The management of manufacturing and service operations. Topics include: flow processes, inventories, scheduling, capacity, and operations strategy. *(Lec. 2 for one-half semester, 2nd half) Pre: 530 and 620 or permission of instructor.* Staff

663 Management Information Systems *(II, 3)* Concepts and problems associated with the design, implementation, and management of information systems. *(Lec. 3) Pre: 500 or equivalent or permission of instructor.* Staff

664 Health Information Systems *(I or II, 3)* Concepts associated with the design, implementation, management, and evaluation of administrative and clinical health information systems. *(Lec. 3) Pre: 500 or equivalent or permission of instructor.* Armstrong, Koza, Humphrey

671 Methods of Business Research *(I and II, 3)* An understanding of research methodology and the culmination of such methodology into a term project. *(Lec. 3) Pre: 530 or equivalent and permission of department.* Staff

681 Operations Management in Service Organizations *(II, 3)* Problems facing operations managers of service organizations are examined. Topics include: flows through services systems, forecasting service demand, capacity planning for service organizations, and scheduling service operations. *(Lec. 3) Pre: 640 or permission of instructor.* Staff

683 Business Decision Theory *(I, 3)* A statistical analysis of managerial decision-making under uncertainty. Bayesian statistical inference and subjective probability are stressed. Comparisons between Bayesian method and classical statistics are discussed and applications to business problems are emphasized. *(Lec. 3) Pre: 520, 530 or equivalent.* Staff

684 Advanced Programming Methods in Management Decisions *(II, 3)* Introduction to integer, nonlinear, and dynamic programming. Emphasis on application of modern mathematical optimization techniques in single-stage and multiple-stage management decision problems. *(Lec. 3) Pre: 520 and 682 or equivalent.* Staff

685 (or FIN 685 or INS 685) Health: Financial Management and Insurance *(I, 3)* Financial and economic analysis of the interactions between consumers and providers of health care, and public and private prepayment and insurance programs. *(Lec. 3)* Staff

686 (or FIN 686 or INS 686) Public Issues in the Health System *(II, 3)* A systematic review of the development and present status of selected policy issues in the social and economic status of the health and medical care system. *(Lec. 3)* Staff

691, 692 Directed Study in Management Science *(I and II, 1-3)* Advanced work under the supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. 1-3) Pre: permission of instructor. Staff*

MKT Courses
Marketing

405 Marketing Communications *(I, 2)*
406 Product Management *(I, 2)*
407 Channels of Distribution *(II, 2)*
408 Pricing Decisions *(II, 2)*
409 Marketing Policy and Problems *(II, 3)*
415 Marketing Research *(II, 3)*
416 Quantitative Marketing Management *(II, 3)*
433 Media Planning *(I, 3)*
434 Advertising Campaigns *(II, 3)*
442 Sales Management *(I, 3)*
451 International Marketing *(II, 3)*
491, 492 Directed Study *(I and II, 1-3 each)*

501 Marketing Theory and Practice *(I and II, 2)* Analytical approach to contemporary theory and practice of marketing management. *(Lec. 2)* Staff

601 Managerial Marketing *(I, 4)* Analysis of marketing problems and determination of marketing policies in product development, promotion, pricing, channel selection; legal aspects. *(Lec. 4) Pre: ECN 590, MGS 520, MGS 530 or equivalent or permission of instructor.* Lysonski or Dholakia

602 Marketing Management *(I, 3)* Analysis of marketing problems and determination of marketing policies in product development, promotion, pricing, channel selection; legal aspects. *(Lec. 3) Pre: 501 or equivalent.* Staff

611 Buyer Behavior *(I or II, 3)* Analysis of major factors influencing the behavior and

demand of consumers. Emphasis on using these factors to identify and segment target markets and to assess the effects of these factors on markets. *(Lec. 3) Pre: 501 or permission of instructor.* Della Bitta and Loudon

615 Marketing Research *(I or II, 3)* Marketing information needs and appropriate means of providing the requisite information are analyzed. Several major marketing decision areas and their research implications are examined in depth. *(Lec. 3) Pre: 601, MGS 520 and 530, ECN 590, or permission of instructor.* Della Bitta

631 Advertising Management *(I or II, 3)* A course oriented to managers responsible for planning, appraising and administering advertising and promotion activities. *(Lec. 3) Pre: 602 or permission of instructor.* Hill and Nason

651 International Marketing Management *(I and II, 3)* Marketing policy making for the multinational firm; organizing for international marketing; its opportunities, pricing, channels, promotion, research. *(Lec. 3) Pre: 501 and 602.* Staff

661 Product Management *(I or II, 3)* Development of product policies and strategies. Emphasis on organizing the marketing function to deal with various product-related activities including new product development, life cycle strategies, and product deletion. *(Lec. 3) Pre: 602.* Hill

691, 692 Directed Study in Marketing *(I and II, 1-3)* Advanced work under the supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. 1-3) Pre: permission of instructor.* Staff

695, 696 Seminar in Marketing *(I and II, 3 each)* Preparation and presentation of papers on selected topics in marketing. *(Lec. 3) Pre: 501, 602, or permission of instructor.* Staff

Business Education

M.S.

Graduate Faculty

Acting chairperson: Professor Clay V. Sink, Ph.D., 1968, Ohio State University
Associate Professor Kathleen F. Smith, Ed.D., 1973, Boston University

Specializations

Administration and supervision of business education, use of audiovisual equipment and materials in business education, consumer education, innovations in teaching business and distributive education, survey of office and distributive occupations, word processing, cooperative education programs, business communications.

Master of Science

Admission requirements: undergraduate grade point average of approximately B or above and a score near the 50th percentile on the MAT examination for full admission. Teaching or supervisory experience is recommended.

Program requirements: undergraduate credit hours in accounting, finance, economics, marketing, management, production, statistics, and business law. Candidates lacking undergraduate courses in business education may be required to make up deficiencies. Thirty credit hours without a thesis, including BED 524, 525, 526; six credits selected from BED 520, 522, 528; three credits in economics at the 400 level or above; three credits selected from EDC 572 and BED 428; six credits in academic business subjects selected from accounting, business law, computer science, economics, finance, insurance, management, management science, and marketing courses; plus three credits of graduate-level free electives at the 500 level or above, and written comprehensive examination.

All 500- and 600-level courses offered by departments in the College of Business Administration are open to matriculated graduate students only, except for BED 528.

BED Courses
Business Education

426 Training and Development Theory and Practice *(I,3)*

428 Coordinating and Developing Curriculum for Cooperative Vocational Business and Distributive Education *(I, 3)*

520 Research and Methods in Teaching Office Occupations Subjects *(I, 3)* Psychological principles of skill building, content, methods of teaching, curriculum materials, current thought, and evaluation in the teaching of office occupations subjects. *(Lec. 2)* Staff

522 Improvement of Instruction in Social Business Subjects *(II, 3)* Research, objectives, methods of instruction, curriculum materials, current thought, and evaluation in the teaching of such subjects as economics, consumer economics, economic geography, business law and general business. *(Lec. 3)* Staff

524 Foundations and Recent Developments in Business Education *(II, 3)* Philosophy and objectives of business education, principles of curriculum development and evaluation, supervisory problems, organization and administration of cooperative part-time programs, historical developments, legislation, recent developments, and current status of business education. *(Lec. 3)* Staff

525 Research Seminar in Business Education *(I, 3)* Analysis of research studies in the field. Research technique applied to business education. Emphasis on reading, interpretation, and application of research findings. Planning research projects. Planning and approval of outline for a field study project required. *(Lec. 3) Pre: a basic course in statistics and permission of department.* Staff

526 Field Study and Seminar in Business Education *(I and II, 3)* Carrying out of the field study project approved in 525 with attendance and participation in seminar meetings. *(Lec. 3) Pre: a basic course in statistics and 525.* Staff

527 Communication for Business *(I and II, 3)* Development of communication principles and practices for business and industry. Emphasis on reporting — written and oral — and correspondence as well as other forms of business communications. Staff

528 Workshop in Business Education *(SS, 1-6)* Trends, current problems, new concepts, and improved methods in the teaching of office and distributive occupations subjects. Topics vary. Maximum of six credits counted toward a degree. Staff

691, 692 Directed Study in Business Education *(I and II, 1-3)* Advanced work under the supervision of a member of the staff and arranged to suit individual requirements of the student. *(Lec. 1-3) Pre: permission of instructor.* Staff

Chemical Engineering

M.S., Ph.D.

Graduate Faculty

Chairperson: Professor Joseph Estrin, Ph.D., 1960, Columbia University
Professor Stanley M. Barnett, Ph.D., 1963, University of Pennsylvania
Professor Richard D. Gonzalez, Ph.D., 1965, The Johns Hopkins University
Professor Harold N. Knickle, Ph.D., 1969, Rensselaer Polytechnic Institute
Professor Thomas J. Rockett, Ph.D., 1963, Ohio State University
Professor George D. Shilling, Ph.D., 1950, University of Wisconsin
Associate Professor Vincent C. Rose, Ph.D., 1964, University of Missouri
Assistant Professor Richard Brown, Ph.D., 1977, University of Cambridge
Assistant Professor Donald J. Gray, Ph.D., 1980, University of Rhode Island
Adjunct Associate Professor A. Francis DiMeglio, B.S., 1952, Providence College
Adjunct Assistant Professor Charles S. Sahagian, B.S., 1950, Boston College
Professor Emeritus Ferdinand Votta, Jr., D.Eng., 1958, Yale University

Specializations

Biochemical and food engineering, materials engineering, transport phenomena, reaction kinetics, energy engineering, pollution control.

Master of Science

Admission requirements: GRE including advanced test in area of applicant's specialization. Bachelor's degree in chemical engineering; candidates from other engineering fields or from mathematics, biology, chemistry, or physics may be accepted into the program with possible addition of prerequisite courses.

Program requirements: thesis option: CHE 501, 502. Non-thesis option for part-time students, with permission of the department; master's examination and comprehensive report with oral examination; CHE 501, 502.

Doctor of Philosophy

Admission requirements: GRE including advanced test in area of applicant's specialization and M.S. degree in engineering (may be waived for University of Rhode Island graduate students who pass qualifying examination with superior performance).

Program requirements: a candidate's program will be determined in consultation with his or her committee and be based on his or her background and career goals. There is no general language requirement but a student's committee may require a foreign language or research tool which may be necessary for the candidate's program. In addition to an acceptable dissertation, a candidate must submit the manuscript of a paper, based on his or her research, suitable for transmission to a technical journal; CHE 501, 502.

CHE Courses
Chemical Engineering

403, 404 (or OCE 403, 404) Introduction to Ocean Engineering Processes I and II *(I and II, 3 each)*

425 Process Dynamics and Control *(II, 3)*

437 Materials Engineering *(I and II, 3)*

447 (or FSN 447) Food Engineering I *(I, 4)*

464 Industrial Reaction Kinetics *(I, 3)*

471 Analysis of Engineering Data *(I or II, 3)*

501, 502 Graduate Seminar *(I and II, 1 each)* Seminar discussions including the presentation of papers based on research or detailed literature surveys. *(Lec. 1) Attendance is required of all students in graduate residence, but a maximum of 1 credit per year is allowed, no more than 2 credits for the entire period.* Staff

530 Polymer Chemistry *(I, 3)* Polymer structure, molecular forces, glass and crystalline transitions, solution properties, polymerization kinetics, molecular weight distribution, fractionation, viscoelastic properties, and transport processes. *(Lec. 3) Pre: CHM 222 and 332 or permission of instructor.* Staff

531 Polymer Engineering *(II, 3)* Polymer processing and mechanical properties of polymers. *(Lec. 3) Pre: 342 or 344 and 530, or permission of instructor.* Staff

532 Ceramic Engineering *(I, 3)* Properties of ceramic materials as related to starting materials and forming, densification, and finishing processes. Emphasis on resulting phases and microstructure. Application of physical and chemical principles to tailor properties to engineering needs. *(Lec. 3) Pre: 437 or equivalent.* Rockett

533 Engineering Metallurgy *(II, 3)* Structures and properties of metals and alloys required to meet typical engineering problems; proper selection of tool materials; properties of stainless steels; materials of special importance in nuclear fields, etc. *(Lec. 2, Lab. 3) Pre: 333 or consent of instructor.* Brown

534 Corrosion and Corrosion Control
See Ocean Engineering 534.

535 Advanced Course in Corrosion
See Ocean Engineering 535.

537 Advanced Materials Engineering *(II, 3)* Engineering properties, molecular design and applications of materials. Synthesis, fabrication and processing of materials. Effects of environment on materials, materials products, devices, and systems. *(Lec. 3) Pre: 437 and PHY 340 or 341.* Staff

539 Electron and Light Microscopy of Solids *(I, 3)* Theory and physical principles governing the design and use of light and electron optical systems in identification, analysis and structural characterization of metals, ceramics, polymers, glasses, and composites. Emphasis on polarized light and scanning electron microscopy. *(Lec. 3) Pre: 437 or equivalent. In alternate years.* Staff

540 Phase Equilibria *(II, 3)* Interpretation, construction, and thermodynamics of one, two, three to n-component phase diagrams with examples of their use in chemical, ceramic, metallurgical, and mineral engineering. *Pre: CHM 341 or equivalent.* Rockett

548 (or FSN 548) Food Engineering II *(II, 3)* A study of methods of concentration used in the food industry for preservation and isolation of products. *(Lec. 2, Lab. 3) Pre: 447 or 348. In alternate years.* Barnett

549 (or FSN 549) Food and Biochemical Engineering III *(II, 3)* Processing of biochemicals with emphasis on protein production, unit operations of protein recovery, immobilized enzyme reactors, and hydrocolloid rheology. *(Lec. 2, Lab. 3) Pre: 447 or FSN 431 or permission of instructor. In alternate years.* Barnett and Rand

572 X-ray Diffraction and Fluorescence *(I, 3)* Fundamentals, properties, and applications of X-rays for identification and chemical analysis of materials, determination of lattice parameters, phase transformations, textures, residual stresses, grain and particle sizes, film and plate thicknesses. *(Lec. 2, Lab. 3) Pre: PHY 340 or 341. In alternate years.* Staff

573 Mechanical Metallurgy *(I or II, 3)* Behavior and response of metals to mechanical plastic forming. Property control by analysis and design of industrial metal processing. Principles of annealing, forging, rolling, extruding, rod, wire, and tube drawing. Recent advances and developments. *(Lec. 3) Pre: permission of instructor.* Brown

574 Biochemical Engineering *(I, 3)* Introduction to biotechnology. Includes properties of biological materials, dynamics, control and operation of biological systems and processing of biological materials. *(Lec. 3) Pre: permission of instructor.* Barnett

575 (or FSN 575) Biochemical Engineering II *(II, 3)* Examines current issues in biochemical engineering with emphasis on developing alternate sources of food energy and chemicals. *(Lec. 2, Lab. 3) Pre: 574 or permission of instructor.* Barnett

581 Introduction to Nuclear Engineering
See Nuclear Engineering 581.

582 Radiological Health Physics
See Nuclear Engineering 582.

585 Measurements in Nuclear Engineering
See Nuclear Engineering 585.

586 Nuclear Reactor Laboratory
See Nuclear Engineering 586.

591, 592 Special Problems *(I and II, 1-6 each)* Advanced work under the supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problem. Credits not to exceed a total of 12.) Pre: permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

613 Advanced Chemical Engineering Thermodynamics *(I, 3)* Applications of the first, second and third laws of thermodynamics and their relation to chemical engineering processes. Emphasis on properties of fluids, chemical and physical equilibria and refrigeration. *(Lec. 3) In alternate years.* Estrin

614 Advanced Chemical Engineering Thermodynamics *(II, 3)* Continuation of 613. *(Lec. 3) Pre: 613.* Staff

625 Automatic Process Control *(II, 3)* Theory of automatic control as applied to industrial processing systems. *(Lec. 3)* Shilling

640 Transport Phenomena I *(I, 3)* Analysis of transport processes in fluids with emphasis on diffusion of matter. *(Lec. 3) Pre: MTH 244*

and CHE 343 or permission of instructor. Knickle

641 Transport Phenomena II *(II, 3)* Interphase transfer, turbulent transport processes, and boundary layer theory, with application to fixed and fluid bed processes, membrane processes, biochemical, biomedical, and electrochemical systems. *(Lec. 3) Pre: 640.* Barnett

643 Fluid Dynamics *(II, 3)* Advanced problem course dealing with isothermal and nonisothermal flow of compressible and incompressible fluids. *(Lec. 3) In alternate years.* Knickle

644 Process Heat Transfer *(II, 3)* Advanced study of heat transfer by conduction in the steady and unsteady state, radiation, and convection. *(Lec. 3) In alternate years.* Knickle

646 Radiation Heat Transfer See Mechanical Engineering 646.

647 Mass Transfer I *(I, 3)* Advanced course dealing with the application of mass transfer theory in the distillation of binary, multicomponent, and complex mixtures. *(Lec. 3) In alternate years.* Gray

648 Mass Transfer II *(II, 3)* Advanced study of vapor-liquid equilibria and mass-transfer theory applied to gas-liquid systems; humidification and gas absorption, simple and multicomponent systems, with and without chemical reaction. *(Lec. 3)* Staff

649 Mass Transfer III *(II, 3)* Advanced study of industrial liquid extraction, adsorption, and ion exchange; liquid-liquid, liquid-solid, and gas-solid phase equilibria; separation cascades, stages, and differential separations: design and performance characteristics. *(Lec. 3) Pre: advanced graduate standing or permission of instructor.* Staff

651, 652 Advanced Design *(I and II, 3 each)* Advanced course in the coordination of chemical or nuclear engineering principles and economics to the design of complete industrial plants. Students work design problems on an individual basis, with the guidance of one or more instructors. Staff

664 Applied Reaction Kinetics *(II, 3)* Application of principles of chemical reaction kinetics to industrial processes. *(Lec. 3) In alternate years.* Staff

691, 692 Special Problems *(I and II, 1-6 each)* Advanced work, under the supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problem. Credits not to exceed a total of 12.) Pre: permission of department.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

NUE Courses
Nuclear Engineering

581 (or CHE 581) Introduction to Nuclear Engineering *(I and II, 3)* Survey course emphasizing the special application of principles learned in the several specialized branches of engineering. Major topics are nuclear physics, problems in design of reactor cores, materials of construction, instrumentation and control, and health physics. *(Lec. 3) Pre: PHY 340 or 341.* Knickle

582 (or CHE 582) Radiological Health Physics *(I, 3)* Fundamentals of health physics and radiation protection are covered. Calibration and use of survey and monitoring equipment are emphasized in the laboratory. *(Lec. 2, Lab. 3) Pre: permission of instructor. In alternate years.* Rose

585 (or CHE 585) Measurements in Nuclear Engineering *(I, 3)* Basic techniques used in measuring the interaction of radiation and matter. Principles of ionization chambers, scintillation counters, related circuitry. Laboratory stresses thorough familiarization with these instruments. *(Lec. 2, Lab. 3) Pre: PHY 340 or 341 or permission of department.* Rose

586 (or CHE 586) Nuclear Reactor Laboratory *(II, 3)* Theoretical and experimental determination of reactor characteristics. Experimental equipment includes a neutron howitzer, a subcritical training reactor, and a one megawatt swimming pool reactor. Digital and analog computer facilities are utilized in calculation. *(Lec. 1, Lab. 4) Pre: 585.* Rose

Chemistry

M.S., Ph.D.

Graduate Faculty

Professor Paul I. Abell, Ph.D., 1951, University of Wisconsin
Professor Christopher W. Brown, Ph.D., 1967, University of Minnesota
Professor Phyllis R. Brown, Ph.D., 1968, Brown University
Professor Alexander M. Cruickshank, Ph.D., 1954, University of Massachusetts
Professor James L. Fasching, Ph.D., 1970, Massachusetts Institute of Technology
Professor Richard D. Gonzalez, Ph.D., 1965, The Johns Hopkins University
Professor Leon Goodman, Ph.D., 1950, University of California, Los Angeles
Professor Wilfred H. Nelson, Ph.D., 1962, University of Minnesota
Professor Harold Petersen, Jr., Ph.D., 1966, University of Illinois
Professor William M. Rosen, Ph.D., 1967, University of California, Riverside
Professor Douglas M. Rosie, Ph.D., 1955, Cornell University
Professor Bruno M. Vittimberga, Ph.D., 1957, University of Illinois
Associate Professor Clair J. Cheer, Ph.D., 1964, Wayne State University
Associate Professor David L. Freeman, Ph.D., 1972, Harvard University
Associate Professor Louis J. Kirschenbaum, Ph.D., 1968, Brandeis University
Assistant Professor William B. Euler, Ph.D., 1979, Florida State University
Assistant Professor R. Ken Forcé, Ph.D., 1974, University of Nebraska
Assistant Professor Sze Cheng Yang, Ph.D., 1973, Columbia University

Specializations

In addition to studies in the four traditional areas, research programs and special facilities are available in organic geochemistry, molecular spectroscopy—theoretical and applied—separations techniques, X-ray crystallography, methods of trace analysis, spectroelectrochemistry, laser applications to trace organic anaylsis, theoretical calculations, heterogeneous catalysis, synthesis of antiviral and antitumor agents, kinetics and mechanisms of organic and inorganic reactions, data management systems, pattern recognition techniques, organic and inorganic synthesis and structure, and photochemistry. Interdisciplinary studies in environmental (air, ocean and freshwater analyses) and biomedical problems.

Master of Science

Admission requirements: GRE, including advanced test. Preference is given to candidates with undergraduate majors in chemistry or chemical engineering with mathematics through calculus.

Program requirements: placement examination to determine specific program requirements, successful completion of master's qualifying examinations; for thesis option (30 credit hours): 12 credits hours of graduate core courses in at least three of the four areas of chemistry, CHM 641 or 642 and thesis; for non-thesis option (36 credit hours): 18 credit hours of graduate core courses, CHM 641 or 642, CHM 551, 552, and written comprehensive examination.

Doctor of Philosophy

Admission requirements: same as for master's degree.

Program requirements: successful completion of qualifying examination; 18 credit hours of graduate core courses, CHM 641-643 (3 credits), reading proficiency in one foreign language (French, German, or Russian) or a research tool (computer science).

CHM Courses
Chemistry

401 Intermediate Inorganic Chemistry *(I, 3)*
412 Instrumental Methods of Analysis *(II, 3)*
414 Instrumental Methods of Analysis Laboratory *(II, 2)*
425 Qualitative Organic Analysis *(I, 2)*
427 Intermediate Organic Chemistry *(I, 3)*
431, 432 Physical Chemistry *(I and II, 3 each)*

501 Advanced Inorganic Chemistry I *(I or II, 3)* Systematic analysis of bonding schemes and structural aspects of molecular systems encountered in inorganic chemistry. Special emphasis on electron density distributions, physical methods of analysis, and practical applications of quantum mechanics. *(Lec. 3) Pre: 401.* Nelson

502 Advanced Inorganic Chemistry II *(II, 3)* Modern inorganic chemistry approached from experimental, theoretical and descriptive points of view. Includes electronic structure and bonding in coordination chemistry, topology, thermodynamics of complex formation, mechanisms, lanthanides and actinides. *(Lec. 3) Pre: 401 or equivalent.* Kirschenbaum

511 Advanced Analytical Chemistry I *(I, 3)* Principles of aqueous and non-aqueous titration. Theory of separations including distillation, solvent extraction, and especially gas and liquid chromatography. Statistical treatment of experimental data. *(Lec. 3) Pre: 412 or permission of instructor.* C. Brown

512 Advanced Analytical Chemistry II *(II, 3)* Continuation of 412 with emphasis on principles and recent developments in application of physiochemical phenomena to solution of chemical problems. *(Lec. 3) Pre: 412, PHY 340, and MTH 243.* Staff

518 Radiochemistry *(II, 3)* Theory and principles of nuclear science as applied to the various fields of chemistry. Radioactivity, radiation detection and measurement, preparation and separation of radionuclides, emphasis on solution of chemical and environmental research problems with the techniques of nuclear chemistry. *(Lec. 3) Pre: 432, PHY 214 or permission of instructor.* Fasching

521 Advanced Organic Chemistry I *(I, 3)* Modern synthetic reactions and their applicability to such areas as natural products and heterocyclic chemistry. *(Lec. 3) Pre: 226 and 228 or equivalent.* Goodman

522 Advanced Organic Chemistry II *(II, 3)* Emphasis on fundamental organic structure theory and reaction mechanisms. *(Lec. 3) Pre: 521 or permission of instructor.* Vittimberga

531 Advanced Physical Chemistry I *(I, 3)* Principles and applications of classical physical chemistry. Includes the three laws of thermodynamics, thermochemistry, phase equilibria, kinetic rate laws, and mechanisms of gas phase reactions. *(Lec. 3) Pre: 432 or permission of instructor.* Yang

532 Advanced Physical Chemistry II *(II, 3)* Introduction to modern chemistry with emphasis on quantum chemistry and statistical thermodynamics. Includes development of quantum theory, applications of quantum theory, development and application of statistical distribution functions. *(Lec. 3) Pre: 432 or permission of instructor.* Yang

535 Chemical Applications of Group Theory *(I, 3)* Fundamental principles of group theory developed as used in simplifying problems of a chemical nature. Group theoretical approach to several typical problems such as hybrid orbitals, molecular orbitals, and molecular vibrations. *(Lec. 3) Pre: 432.* Staff

536 Molecular Spectroscopy and Structure *(II, 3)* Theory of molecular dynamics, interaction of electromagnetic radiation with matter. Absorption and emission spectra in infrared, far-infrared, and microwave regions. Raman scattering in the visible region. Use of spectral results in determining physical properties and elucidating molecular structures will be emphasized. *(Lec. 3) Pre: 535 or permission of instructor.* Brown

544 Data Processing in Chemistry *(II, 3)* An introduction to the use of computers for acquisition, storage, and analysis of chemical data. Types of computer systems and software packages available to the chemist and their effective integration into chemistry-related projects. *(Lec. 2, Lab. 3) Pre: 431 and a one-semester course in FORTRAN programming or equivalent. In alternate years, next offered spring 1984.* Petersen

551, 552 Non-Thesis Masters Research *(I and II, 3 each)* Research on original problem for fulfillment of research requirement of non-thesis master's degree. Literature survey, laboratory work and detailed report required. *(Lab 9) Pre: permission of department.*

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. A minimum of six credits is required of students who have chosen the thesis option for the master's degree.

602 The Transition Metals *(I, 3)* Ligand field theory and its applications. Basic quantum mechanical calculations involving thermodynamical, spectral, and magnetic properties of transition metal compounds. *(Lec. 3) Pre: 530. In alternate years, next offered fall 1983.* Nelson

608 Inorganic Reaction Mechanisms *(I or II, 3)* Kinetics and mechanisms of reactions in aqueous solution: techniques, results, and theoretical interpretation. Instrumentation for studying rapid reactions in solution, relaxation methods, electron transfer rates, hydrolytic and solvolytic reactions, metal ion complexation, reactions of biochemical significance. *(Lec. 3) Pre: 502 or permission of instructor.* Kirschenbaum

615 Trace Analysis of Inorganic Substances *(I, 3)* Principles of trace analysis. Emphasis on techniques and instrumentation. The advantages and limitations of such techniques as atomic absorption spectroscopy, neutron-activation analysis, flame emission X-ray fluorescence will be presented. *(Lec. 3) Pre: 511 or permission of instructor.* P. R. Brown

616 Applied Analytical Techniques *(II, 3)* Application of analytical instrumentation and techniques to practical problems. Limitations and specific difficulties of analyzing complex matrices in practical research. Problem oriented presentation. *(Lec. 3) Pre: 511 and 512 or permission of instructor.* P. R. Brown

617 Advanced Instrumentation *(I, 3)* Basic design and theory of design of instruments. Discussion of advantages and limitations of specific instruments. Current research in instrument design and critical evaluation of designs. *(Lec. 3) Pre: 511 and ELE 220 or 537 or its equivalent.* Forcé and Fasching

618 Theory of Separations *(II, 3)* Companion to 615. In-depth presentation of theory of separation processes. Emphasis on methods development, advanced topics, and current advances using gas and liquid chromatography. *(Lec. 3) Pre: 511 or permission of instructor.* P. R. Brown

622 Advanced Organic Synthesis *(II, 3)* Discussion of modern synthetic methods for the construction of complex chemical structures. *(Lec. 3) Pre: 522.* Cheer

626 Free Radicals and Photochemistry *(I, 3)* Theory of formation and detection of free radicals and photexcited states. Bond homolysis, additions, oxidation, polymerization, rearrangements, and other free radical reactions. *(Lec. 3) Pre: 521, 522 or equivalent.* Abell

627 Organic Intermediates *(I, 3)* The formation, reaction, and decomposition of short-lived organic intermediates will be explored with special emphasis on the carbonium ion, carbanion, and carbene species. *(Lec. 3) Pre: 521.* Staff

628 Organometallic Chemistry *(II, 3)* The interaction of the organic and inorganic moieties and their effects upon each other. Special emphasis will be placed on the interaction of organic moieties with the transition and main group metals. *(Lec. 3) Pre: 502.* Rosen

636 Advanced Topics in Physical Chemistry *(II, 3)* Advanced topics in quantum chemistry and statistical thermodynamics. Time-dependent and independent perturbation theory, interaction of light with matter, electronic structure of atoms and

molecules, Hartree-Fock theory, classical and quantum statistical mechanics. *(Lec. 3) Pre: 529, 532, or permission of instructor.* Freeman

641, 642, 643, 644 Graduate Seminar *(I and II, 1 each)* Results of detailed literature surveys are presented orally and in writing. Required for candidates for advanced degrees in chemistry. *(Lec. 1) S/U credit.* Staff

691 Special Topics *(I and II, 1-3)* Covers the following special research interests: (a) carbohydrate chemistry, (b) chemical kinetics, (c) clinical chemistry, (d) computer techniques in analytical chemistry, (e) forensic chemistry, (f) free-radical rearrangements, (g) recent advances in analytical chemistry, (h) light scattering, (i) molecular orbital theory, (j) pericyclic reactions, (k) surface chemistry, (l) X-ray analysis of organic molecules. *(Lec. 2) May be repeated up to a maximum of 6 credits. Pre: permission of instructor.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Child Development and Family Relations

M.S.

Graduate Faculty

Chairperson: Professor Franklin Zweig, J.D., 1975, State University of New York, Buffalo
Professor Stewart Cohen, Ph.D., 1967, Purdue University
Professor George T. Fitzelle, Ph.D., 1952, Cornell University
Professor Peter E. Maynard, Ph.D., 1969, State University of New York, Buffalo
Professor Gwenneth Rae, Ed.D., 1972, University of California
Professor Donald L. Spence, Ph.D., 1965, University of Oregon
Associate Professor Helen F. Greene, Ph.D., 1954, Florida State University
Associate Professor Thomas J. Gunning, Ed.D., 1966, Boston University
Associate Professor Alfred C. Pascale, Ed.D., 1958, Boston University
Associate Professor Jerome A. Schaffran, Ph.D., 1971, University of Iowa
Assistant Professor Nancy Blackman, Ph.D., 1976, University of Maryland
Assistant Professor Linda L. Blood, M.S., 1965, Oklahoma State University
Assistant Professor Constance E. Cooper, M.S., 1950, Cornell University
Assistant Professor Karen A. Schroeder, Ph.D., 1977, University of Connecticut
Professor Emerita Mollie S. Smart, Ph.D., 1970, University of Delhi
Professor Emeritus Russell C. Smart, Ph.D., 1938, University of Minnesota

Specializations

Human development, family studies, early childhood development, adulthood, gerontology, marital and family counseling.

Master of Science

Admission requirements: GRE or MAT and 18 undergraduate credit hours distributed among at least three of the following areas: child development and family relations, psychology, sociology, biology, education. The marital and family counseling option requires at least 15 credits in family relations, developmental theory, personality theory or family sociology. Selection for admission to this option is highly competitive and enrollment is limited. This program adheres to the standards established by the American Association for Marriage and Family Therapy (AAMFT).

Program requirements: 24 course hours plus 6 credits toward thesis or 6 related action research credits (30 credit hours total minimum) and comprehensive examination. The marital and family counseling option requires 45 hours of approved graduate courses including a 30-hour core and 15 hours of approved electives. This program involves intense practical and internship experience in cooperating agencies, therefore full-time students are preferred.

State Provisional Certification

Persons wishing to meet state provisional teacher certification requirements (Nursery-Kindergarten) must apply for admission to teacher certification (non-degree status). Official transcripts of all previous coursework, plus two letters of recommendation are required. As a prerequisite to enrolling in courses which meet certification requirements, accepted applicants must complete or have completed the equivalent of an undergraduate degree in CDFR.

HCF Courses
Human Development, Counseling and Family Studies

400 Child Development: Advanced Course *(I, 3)*
406 Growth and Development During Infancy *(I, 3)*
420 Human Development During Adulthood *(I and II, 3)*
421 Death, Dying and Bereavement *(II, 3)*
422 Aging: Case Coordination *(I, 3)*
430 Family Interaction *(I, 3)*
431 Family and the Elderly *(II, 3)*
432 Perspectives on Parenting *(II, 3)*
433 Family Life Education *(II, 3)*
434 Children and Families in Poverty *(II, 3)*
435 Developmental Assessment in Early Childhood *(SS, 6)*
450 Introduction to Counseling *(I and II, 3)*
497, 498 Special Problems *(I and II, 2-4 each)*

500 Child Development Seminar *(I or II, 3)* Intensive study of selected topics, such as development of cognitive processes, individual and group differences in development of language, hereditary factors in physical growth. Review papers by students presented to class. *(Lec. 3) Pre: 400 or permission of department.* Staff

501 Seminar in Early Childhood Education *(I and II, 3)* Seminar in trends and model programs in early childhood education. Special attention to substantive evaluation and program design issues for the professional early childhood educator. *(Lec. 3) Pre: student teaching or equivalent classroom experience or consent of instructor.* Rae

502 Cognitive Aspects of Early Childhood Education *(I and II, 3)* Impact of theory and research in cognitive development and its relation to language, learning, and thinking. Special attention to Piaget's impact on current research and educational programs. *(Lec. 3) Pre: 200, 201, or consent of instructor.* Rae

505 Theories and Issues in Human Sexuality *(I, 3)* Interdisciplinary inquiry into the significance of sexuality in human experience. Historical, cultural, and deveopmental issues in human sexuality. Implications for self understanding. *(Lec. 3) Pre: permission of instructor.* Blackman

520 Developmental Issues in Later Life *(I, 3)* Theoretical and philosophical foundations for understanding the normal changes, pathological developments, clinical assessments, and intervention strategies associated with late life. *(Sem.) Pre: graduate standing.* Spence

530 Family Relations Seminar *(II, 3)* Intensive study of selected topics such as family theory, contemporary family issues, and family therapy. *(Lec. 3) Pre: 330 or permission of instructor.* Staff

535 Families Under Stress: Coping and Adaptation *(I or II, 3)* Theoretical models of family interaction, development, and stress as applied to understanding of family behavior in managing stress or events. Concepts of stress, vulnerability, adaptability, coping, regenerative power, social supports, and related research. *(Lec. 3) Pre: 430, 570 or equivalent graduate coursework in family development or family sociology and permission of instructor.* Maynard

550 Vocational Information and Career Development *(I and II, 3)* Classification and description of jobs and industries; study of occupational trends; needs of special groups entering the labor market; vocational development theories and counseling for long-range career planning. *(Lec. 3) Pre: 450 and graduate standing.* Staff

551 Counseling Techniques *(I and II, 3)* Foundation of the theory and practice, with special emphasis upon approaches to counseling in various educational settings; primarily designed for preparation of school

counselors and student personnel educators. *(Lec. 3) Pre: 450 and graduate standing.* Staff

553 Counseling Practicum *(I and II, 3)* Advanced counseling. Multiple counseling sessions using tapes and supervised observation to help measure individual assessment of growth and competence. *(Lec. 1, Lab. 5) Pre: 450, 550, 551, PSY 434, and permission of instructor.* Staff

554 Individual Appraisal in Guidance *(II, 3)* Nature of the appraisal process and data essential to understanding the educational, vocational, and social needs of persons. Emphasis on the team approach in pupil personnel services and the use of case materials. *(Lec. 3) Pre: PSY 434 and HCF 551.* Staff

555 Gerontological Counseling *(I, 3)* An overview of the developmental process of later life particularly relevant to counselors. Counseling implications and therapeutic strategies will be emphasized. *(Lec. 3) Pre: 450, 420, or equivalent; graduate standing.* Gunning

559 Counseling of Women *(I or II, 3)* Techniques for helping counselors and clients, male and female, deal with issues and needs growing out of society's changing views about women. Emphasis upon research, counselor-self-awareness, and evaluation. *(Lec. 3) Pre: 450, 551, permission of instructor.* Staff

560 Group Procedures in Counseling *(I and II, 3)* Principles and techniques of group counseling applied to education, counseling, and student personnel work. An experiential and didactic approach with emphasis upon facilitation techniques, leadership patterns, and counseling skills. *(Lec. 3) Pre: permission of instructor.* Staff

562 Organization Development in Education *(II, 3)* Theory and technology of organization development as applied in educational agencies; entry diagnosis, implementation, and evaluation strategies, skills practice in consulting and training; evaluation and research of change efforts. *(Lec. 2, Lab. 4) Pre: 560. In alternate years.* Maynard

563 Marital and Family Counseling I *(I, 3)* Major theoretical perspectives, including system theory as related to therapy. Communication and relationship skills, negotiation and behavioral contracting, treating specific relationship problems, therapy evaluation. *(Sem. 3) Pre: 330, 430 and permission of instructor.* Fitzelle

564 Marital and Family Counseling II *(II, 3)* Major contemporary theories of family therapy and the development of family therapy as a unique intervention strategy; special consideration of issues and problems commonly confronted in conducting family therapy. *(Lec. 3) Pre: 563.* Maynard

565 Family Counseling Practicum *(I and II, 3)* Supervised clinical experience in marriage and family counseling. Case materials will be presented by students and taped segment of actual counseling sessions will be reviewed. *(Lec. 1, Lab. 5) Pre: 563, 564 and permission of instructor.* Maynard

567 Principles and Practices of Student Personnel Services in Higher Education *(I, 3)* Survey of the historical, psychological, organizational, and educational factors which have evolved and combined to form student personnel work. *(Lec. 3) Pre: 553 and 554.* Staff

568 Organization and Administration of Student Personnel Services in Higher Education *(II, 3)* Systematic analysis of current practices in the alignment and operation of student personnel services, with continuing review of their interrelationships with the total educational program. *(Lec. 3) Pre: 553, 554 and 567.* Staff

570 The Study of Children and Families *(I, 3)* Historical, philosophical, and procedural foundations of scientific inquiries of children and families. Exploration of various perspectives applicable to the acquisition of information about human development and family relationships. *(Lec. 3) Pre: graduate standing or permission of department.* Staff

580, 581 Professional Seminar in Counseling *(I and II, 3 each)* A two-semester sequence examining legal, ethical, and professional issues and standards related to counseling, and an analysis of problems encountered in the internship experience. Concurrent registration with 583, 584. *(Lec. 3) Pre: 553, 560 and EDC 529 or HCF 570.* Pascale and Gunning

582 Field Experience with Exceptional Children *(I and II, 3)* Interdisciplinary seminar and laboratory with observation and supervised projects with exceptional children. Psychological, physical, and social factors pertinent to teaching in child development centers. *(Lec. 1, Lab. 4) Pre: 303 or equivalent and permission of department.* Staff

583, 584 Master's Counseling Internship *(I and II, 3 or 6 each)* Supervised field practice in mental health or family agencies, schools, or colleges to integrate counseling theories and skills. *Pre: concurrent registration in 580 for 583, 581 for 584.* Maynard, Pascale and Fitzelle

595 Master's Project: Action Research *(I and II, 1-6)* Number of credits is determined each semester in consultation with the major professor. Minimum of six credits is required of students who have chosen the action-thesis option. One to six credits may be taken. *S/U credit.*

597, 598 Advanced Study *(I and II, 3 each)* Survey of important research contributions significant to understanding of human development and relationships. *(Lec. 3)* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. Minimum of six credits is required of students who have chosen thesis option.

Civil and Environmental Engineering

M.S., Ph.D.

Graduate Faculty

Chairperson: Professor William E. Kelly, Ph.D., 1972, University of Notre Dame
Professor Vito A. Nacci, M.S., 1949, Harvard University
Professor Calvin P. Poon, Ph.D., 1964, University of Illinois
Professor Armand J. Silva, Ph.D., 1965, University of Connecticut
Associate Professor Alan S. Marcus, Ph.D., 1969, University of Massachusetts
Associate Professor Everett E. McEwen, D.Eng., 1964, Rensselaer Polytechnic Institute
Associate Professor Donald L. Sussman, Ph.D., 1966, Polytechnic Institute of Brooklyn
Associate Professor Daniel W. Urish, Ph.D., 1978, University of Rhode Island
Assistant Professor Joan Al-Kazily, Ph.D., 1979, University of California
Assistant Professor Cheng-Jung Chang, Ph.D., 1981, Purdue University
Assistant Professor Raymond M. Wright, Ph.D., 1981, Pennsylvania State University
Adjunct Associate Professor Michael C. Apostal, Ph.D., 1974, State University of New York, Buffalo

Specializations

Environmental Engineering: water supply and treatment facilities, municipal and industrial waste treatment, flocculation and coagulation of wastes, pollution of marine sediments, solid waste management, modeling of environmental systems, ground water pollution, salt water intrusion.

Soil Mechanics: properties of marine sediments, deep anchor systems, seabed disposal of radioactive waste, sediment sampling, dredge material deposition, ground water hydrology, modeling of aquifers, deep sea sedimentary processes, sediment transport, geophysical methods.

Structural Engineering: matrix and finite element analysis, computer and numerical methods, marine structures, structural stability, thin-walled structures, coastal structures.

Master of Science

Admission requirements: GRE and bachelor's degree in civil or environmental engineering. Candidates in other engineering fields or in mathematics, biology, chemistry or physics may be accepted with the possible addition of prerequisite courses.

Program requirements: thesis or non-thesis option. 30 credit hours plus CVE 601, 602; a minimum of two courses taken outside the department. Non-thesis option requires comprehensive report and comprehensive examination.

Doctor of Philosophy

Admission requirements: GRE and master's degree in civil or environmental engineering or in a related field.

Program requirements: Twenty-four credits of course work, which includes the two-course minor outside the candidate's area of specialization, where required, comprehensive examination, and dissertation. Although there is no formal departmental language requirement, the candidate's committee may require proficiency with a research tool or in a foreign language. The candidate's committee may also require a two-course minor outside the candidate's area of specialization.

CVE Courses
Civil and Environmental Engineering

442 Traffic Engineering *(I, 3)*
446 Transportation Engineering *(II, 3)*
470 Water Supply and Treatment *(II, 3)*
471 Municipal Waste Water Systems *(I, 3)*
472 Industrial Air Pollution *(I or II, 3)*
473 Analysis of Air Pollutants *(I or II, 3)*
478 Solid Waste Disposal and Management *(II, 3)*
481 Soil Behavior *(I, 3)*
482 Soil Engineering *(II, 3)*
483 Foundation Engineering *(II, 3)*
491, 492 Special Problems *(I and II, 1-6 each)*
495 Civil and Environmental Engineering Systems *(I, 3)*

524 (or OCE 524) Marine Structural Design *(II, 3)* Includes the design of marine structures, consideration of marine construction materials, waterfront structures, ocean towers, and underwater structures. *(Lec. 2, Lab. 3) Pre: 353.* McEwen

551 Advanced Structural Analysis *(I or II, 3)* Deflections of planar structures using energy concepts and elastic curve principles. Analysis of indeterminate planar structures using advanced techniques. Flexibility and stiffness matrices. *(Lec. 3) Pre: permission of department.* Staff

565 Response of Structures to Dynamic Loads *(I or II, 3)* Behavior of materials and components in civil engineering structures. Numerical and exact methods applied to response in the elastic and inelastic range. Matrix analysis. *(Lec. 3) Pre: permission of department.* Staff

570 Sanitary Chemistry *(I, 3)* Application of analytical chemistry to analysis of natural waters; physical chemistry and organic chemistry of aqueous media; chemical principles applicable to operations of sanitary engineering. *(Lec. 3) Pre: permission of instructor.* Sussman

571 Sanitary Chemistry Laboratory *(II, 3)* Applications of chemical laboratory procedures to control of water and waste water treatment processes. *(Lec. 2, Lab. 3) Pre: 570.* Sussman

572 Biosystems in Sanitary Engineering *(I or II, 3)* Microorganisms which constitute the biological systems in water pollution, water purification and waste water treatment. Application of principles of microbiology and biochemistry to analysis and design in fields of sanitary engineering and water resources. *(Lec. 3) Pre: permission of instructor.* Poon

573 (673) Theory of Water Purification and Treatment *(I, 3)* Principles of modern water purification and engineering practices. Aeration, deodorization, sterilization, coagulation, filtration, water softening, iron removal, disinfection, and corrosion control. *(Lec. 3)* Staff

575 Open Channel Hydraulics *(I or II, 3)* Analysis of uniform, critical, varied flow, and unsteady flow in open channels. Principles will be applied to open channel design. *(Lec. 3) Pre: MCE 354.* Poon

586 Physico-chemical Properties of Soils *(I, 3)* Influence of physico-chemical properties of soils on engineering characteristics and performance. Application of mineralogy, ion exchange, and colloidal theory; effect of marine environment, and the nature of soil water. *Pre: 481 or permission of instructor. Offered in the fall of odd calendar years.* Staff

587 Groundwater Flow and Seepage Pressures *(I, 3)* Hydrodynamics of fluid flow through porous media. Analytical methods for steady and unsteady seepage in aquifers; theoretical analysis with practical modification of seepage problems involving foundations, drainage structures, earth dams, and wells. *(Lec. 2, Lab. 3) Pre: 381 and permission of instructor. Offered in the spring of odd calendar years.* Kelly

588 Groundwater Hydrology *(II, 3)* Quantitative methods of groundwater hydrology including determination of aquifer properties and yield. Modeling of groundwater systems for management quantity of water and movement of contaminants. Field and laboratory measurements. *(Lec. 2, Lab. 3) Pre: MCE 354 and CVE 381 or equivalent. Offered in spring of even calendar years.* Kelly

596 Numerical Methods in Structural Engineering *(I or II, 3)* Methods of successive approximations and numerical procedures in the solution of stress, vibration, and stability problems in structural members. Nonuniform members, elastic supports, plates, torsion. *(Lec. 3) Pre: permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

601, 602 Graduate Seminar *(I and II, 1 each)* Discussions and presentation of papers based on research or detailed literature surveys. *(Lec. 1) Required of all students in graduate residence, but a maximum of 1 credit per year is allowed, no more than 2 credits for the entire period.* Staff

650 Advanced Structural Analysis *(I, II, 3)* Continuation of 551. Analysis of indeterminate trusses, structures with nonprismatic members, and shell and folded plate structures. Investigation of secondary stresses. *(Lec. 3) Pre: permission of department.* Staff

651 Plate Structures *(I or II, 3)* Fundamental theories of bending and buckling of plates with practical application to the design of structural plate components of metal and reinforced concrete. *(Lec. 3) Pre: permission of instructor.* Staff

652 Shell Structures *(I or II, 3)* Membrane and bending theories of thin shells and their practical application to the design of shell and folded-plate structures of metal and reinforced concrete. *(Lec. 3) Pre: 651 or permission of instructor.* Staff

655 Matrix Methods in Structural Analysis *(I or II, 3)* Development of finite-element methods of structural analysis. Application to stress problems and to plate and shell structures. *(Lec. 3) Pre: permission of instructor.* Fang

671 Advanced Waste Water Treatment *(I or II, 3)* Latest developments in biological and physiochemical treatment processes. Emphasis on the tertiary treatment of sewage and the ultimate treatment of industrial wastes. Laboratory measurements. *(Lec. 2, Lab. 3) Pre: 570 or permission of instructor.* Poon and Sussman

672 Water Pollution Control and Treatment of Waste Water *(I or II, 3)* Waste water characteristics, effects and purification in natural water, government control strategies and impacts, cost of control, theory and mathematical concepts of secondary and tertiary treatment process, their limitations and late developments. *(Lec. 3) Pre: one year chemistry, biology, MTH 243, CVE 572 or their equivalent and permission of instructor.* Poon

674 Sanitary Engineering Laboratory *(I or II, 3)* Advanced phases of sewage treatment and purification including sludge digestion,

sludge gas analysis, biochemical oxygen demand, conditioning of sludge, activated sludge, sewage trickling filters, and chemical precipitation. *(Lec. 2, Lab. 3) Pre: permission of instructor.* Poon

675 Sanitary Engineering Design *(I or II, 3)* Functional design of modern water treatment plant providing treatment of water for domestic and industrial consumption. *(Lec. 1, Lab. 6) Pre: permission of instructor.* Poon

676 Sanitary Engineering Design *(I or II, 3)* Functional design of modern sewage treatment works providing treatment of sewage. *(Lec. 1, Lab. 6) Pre: 673.* Staff

677 Stream and Estuarine Analysis *(I or II, 3)* Fundamentals and mathematical concepts of physical and biological factors applied to the evaluation of the pollution capacity of streams and estuaries. *(Lec. 3) Pre: MTH 244.* Staff

678 Industrial Waste Water Treatment *(I or II, 3)* Advanced considerations of industrial waste disposal problems of major waste producing industries, including waste producing processes, composition of waste waters, treatment methods, and in-plant abatement techniques. *(Lec. 3) Pre: permission of instructor.* Poon and Sussman

681 Advanced Soil Mechanics *(I, 3)* Index properties and physical properties of soils. Laboratory and field procedures for soil identification. Permeability and flow of water through soils. Compressibility characteristics of soils and consolidation theories as applied to settlement analysis. *(Lec. 2, Lab. 3) Pre: 521 or equivalent. Offered fall of even calendar years.* Staff

682 Advanced Soil Mechanics *(II, 3)* Stress analysis, elastic theory of stress distribution in soils. Application of consolidation theory. Shearing phenomena in soils with application to bearing capacity, earth pressure, and slope stability. Pile foundation analysis. Special topics. *(Lec. 3) Pre: 681. Offered spring of even calendar years.* Staff

685 (or OCE 685) Seminar in Marine Geotechniques *(I, 1)* Class discussions of selected topics in marine geotechniques based on extensive reading in the scientific literature. A research paper by each student and lectures will supplement discussions. *(Lec. 1) Pre: permission of instructor. Offered fall of odd calendar years.* Staff

691, 692 Special Problems *(I and II, 1-6 each)* Advanced work, under the supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problems.) Credits not to exceed a total of 12. Pre: permission of department.* Staff

696 Numerical Methods in Structural Engineering *(II, 3)* Continuation of 596. Applications of relaxation, finite differences, ordinary and partial differential equations to blast loads on structures, bending of plates, and buckling of beams. *(Lec. 3) Pre: 596 or permission of instructor.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. Staff

Community Planning and Area Development

M.C.P.

Graduate Faculty

Chairperson: Professor Thomas D. Galloway, Ph.D., 1972, University of Washington
Professor Dieter Hammerschlag, M.Arch., 1954, M.C.P., 1955, Yale University
Associate Professor Marcia Feld, Ph.D., 1973, Harvard University
Associate Professor Howard H. Foster, Jr., Ph.D., 1970, Cornell University
Associate Professor John J. Kupa, Ph.D., 1966, University of Minnesota
Adjunct Professor Douglas Johnson, Ph.D., 1979, Massachusetts Institute of Technology
Adjunct Professor Carol J. Thomas, M.S., 1948, University of Connecticut
Adjunct Associate Professor Glenn R. Kumekawa, M.A., 1956, Brown University

Specializations

The curriculum aims to educate and train planners for professional positions in community planning and development agencies in either the public or the private sector. In addition to a general background in substantive theory and methods relating to urban or urbanizing communities, two major concentration areas are offered: the small town in exurban or rural areas, and the central city in its metropolitan environment. Emphasis is on the physical and environmental components of communities, as well as on intergovernmental and intra-governmental policies and programs dealing with development or re-development. Electives are available in the areas of urban design, coastal planning, natural resources planning, and economic development planning.

Master of Community Planning

Admission requirements: GRE, undergraduate background in the social sciences, architecture, landscape architecture, natural resources, engineering or geography preferred. Prerequisite courses (for the degree vs. admission): Required — undergraduate course in social statistics; Recommended — undergraduate courses in computer science and economics. The degree is recognized for accrediting purposes by the American Planning Association.

Program Requirements: CPL 501, 510, 511, 512, 525, 526, 522, 523, 630; 12 hours in selected concentration (610-612 or 620-622); thesis or CPL 589; summer internship or equivalent experience. The two-year program of 54 credit hours is distributed one-half in core courses and about one-half in elected concentration, free electives, and thesis. Students normally take 12-15 credits per semester to complete studies in two years.

CPL Courses
Community Planning

410 Fundamentals of Urban Planning *(I or II, 3)*

434 Introduction to Environmental Law *(I, 3)*

501 Introduction to Community Planning History and Theory *(I, 3)* The development of community planning in the U.S., history of governmental planning and evolution of the planning profession, and theoretical elements and constructs basic to contemporary planning practice. *(Lec. 3)* Foster

510 Community Planning and Political and Social Change *(I, 3)* Introduction to community political systems and central theories of the determinants for social and planned change in urban and urbanizing communities. Focus on methodologies of political and social assessments. *(Sem. 3)* Feld

511 Planning and Natural Environmental Systems *(I, 3)* Introduction to theories, methodologies, and substantive concerns of environmental resource analysis with attention given to coastal environmental issues. Focus on land, soils, watersheds, water quality, vegetation, air quality, wildlife, noise pollution. *(Lec. 3)* Kupa

512 Spatial and Fiscal Relationships of Communities *(II, 3)* Introduction to theories and methods of spatial settlement, determinants of residential, commercial, and industrial markets and location and dimensions of public finance and fiscal analysis. Focus on metropolitan and non-metropolitan communities. *(Sem. 3)* Galloway

516 Seminar on the Urban Waterfront See Geography and Marine Affairs 516.

522 (601) Planning Law *(I, 3)* General review and discussion of legal principles and thought concerned with property rights, political power, and the legal aspects pertinent to the planning and development of public and private activities. *(Lec. 3) Pre: second year graduate standing or permission of instructor.* Staff

523 (608) Planning Theory *(I, 3)* Critical survey of planning theories and contemporary planning concepts. Values, assumptions, and processes of various planning paradigms as related to decisions in community planning. Specific emphasis on contingent planning theory. *(Sem. 3)* Galloway

524 (508) Research Methods *(II, 3)* A basic foundation for independent research directed toward the production of a thesis at the master's level. Basic concepts of problem definition, formulation, and testing of hypotheses, and the relation of research to theoretical concepts. *(Lec. 3) Pre: 525 or permission of instructor. Offered in alternate years.* Staff

525 (505) Introduction to Planning Methods *(I, 3)* Introduction to basic methods in comprehensive and functional area planning. Emphasis on development of manual skills in basic demographic, economic, and land use projections; project planning management and evaluative techniques. *(Sem. 3) Pre: EST 408 or permission of instructor.* Feld and Foster

526 (506) Planning and Policy Analysis *(II, 3)* Advanced seminar in computer-aided techniques applied to 525 methods. Use of SPSS/SAS packages. Additional methods include survey research methodology, data collection/formatting, and application of statistical techniques. *(Sem. 3) Pre: 525.* Staff

530 (531) Urban Design and Public Policy *(I, 3)* Significant concepts of historical and contemporary urban form ranging from entire city to architectural details. Public policy initiatives; historic preservation, architectural review boards, signage control. Use of slides and films. *(Lec. 3) In alternate years.* Hammerschlag

533 (624) Planning and Intergovernmental Relations *(II, 3)* Emphasis on planning within the intergovernmental arena with special attention to coordination and implementation on a multi-jurisdictional basis. State and local level focus on area-wide coordinating and evaluation mechanisms. *In alternate years. (Sem. 3)* Galloway

535 (515) Human Resources Planning *(I, 3)* Human resources planning in the community planning and development. Emphasis on social implications of urban development with attention to processes and delivery system planning for education, health, and social services. *(Sem. 3) Pre: 510 or permission of instructor. In alternate years.* Feld

536 (520) International Comparisons in Community Planning *(II, 3)* Community and regional development issues and policies in advanced and developing countries. Emphasis on the generation and spatial patterns of economic development and related public policies and capital investment strategies. *(Sem. 3) In alternate years.* Foster

537 (521) (or REN 532) Land Resources Economics *(II, 3)* The study of economic relationships of man and scarce natural and man-made resources. Supply and demand, rent theory, resources conservation, and the impact of public policy and law. *(Lec. 3)* Staff

538 (532) Site Planning *(I, 3)* Site analysis and planning, including street design, principles of house grouping, and residential subdivision layout. *(Lec. 2, Lab. 3) Pre: 520 or permission of instructor. In alternate years.* Hammerschlag

539 (534) Environmental Law *(II, 3)* Alternative policy approaches involving economic, ecological and political sciences. Technological, planning and legal issues in protection, control, and development of the environment. Particular focus on coastal communities. *(Lec. 3)* Doherty

540 (539) Historic Preservation Seminar *(I, 3)* Survey of historic planning emphasizing what should be preserved; threats to preservation; means for accomplishing preservation of historic buildings and districts, including various legal tools and actual case histories. *(Lec. 3) In alternate years.* Staff

541 (540) Urban and Rural Housing Policy *(I, 3)* Assessment of urban and rural housing needs; relationship of housing to national economic policy; housing finance; production and cost characteristics; tax policy, filtering and neighborhood change; and housing policy assessments. *(Sem. 3) Pre: 410 or 501 or permission of instructor. In alternate years.* Galloway

542 (541) Employment Planning *(II, 3)* A review of employment planning at all levels of government. Concentration on the problems of unemployment in the central city; labor supply and demand, employment forecasting, and projection techniques. *(Lec. 3)* Staff

543 (552) Social Indicator Analysis in Planning *(II, 3)* The use of social and economic indicators in planning and policy analysis. Quantitative description and analyses of social conditions and trends designed to provide information to governmental and institutional policy makers. *(Sem. 3) Pre: 510 or permission of instructor. In alternate years.* Feld

545 Land Development Seminar *(II, 3)* A study of land management techniques including zoning, sub-division regulation, and land suitability and analysis; their use, and environmental implications in land and water development. *(Sem. 3) Pre: 511 or permission of instructor.* Kupa

546 (623) Urban and Rural Transportation *(II, 3)* Issues confronting planning for urban and rural transportation systems; the variety of policies governments pursue in issues and problems; technical and political constraints, transportation studies, and demand analysis techniques. *(Lec. 3) Pre: 410 or 501 or permission of instructor. In alternate years.* Galloway

547 Planning Behavior and Organizations *(II, 3)* Examination of interpersonal relationships in the professional practice of community planning. Emphasis on roles and related social-psychological aspects of bureaucratic organizational life. *(Sem. 3) In alternate years.* Foster

548 Planning and Capital Improvement Programming *(I, 3)* The concepts and techniques of capital improvement programming are presented and tied to their effects on plan objectives, growth management strategies, operating budgets, financing, and revenues. *(Lec. 3) Pre: 530 or permission of instructor. In alternate years.* Hammerschlag and Galloway

549 Seminar in Ecological Planning *(II, 3)* Advanced seminar in ecological planning. Emphasis on hazardous waste, power plant siting, major transportation facilities, solid waste, aquifer protection, among others. Particular emphasis on wetlands and marine/coastal settings. *(Sem. 3) Pre: 511 or permission of instructor.* Kupa

589 Masters Project Research *(I and/or II, 1-6)* A substantial, self-directed planning project, by one or several students, under general guidance of a major professor. Number of credits to be determined each semester. Staff

591, 592 Special Problems in Planning *(I or II, 1-6 each)* Individual investigation of special problems in planning. Staff

593-598 Special Problems in Planning *(I or II, 1-6 each)* Group investigation of special problems in planning. Staff

599 Masters Thesis Research *(I or II, 1-6)* Number of credits is determined each semester in consultation with the major professor or program committee.

610 Urbanization of Small Communities *(II, 3)* Advanced concentration course in small town planning. Emphasis on economic development, land use, agricultural land preservation and use conflicts, socioeconomic characteristics, public facilities, and fiscal relations. *(Lec. 3) Pre: 501, 511, 525, or permission of instructor.* Galloway and Foster

611 Planning Analysis in Small Communities *(I, 6)* Advanced studio seminar concerning analyses required for small town planning. Emphasis on methods of comprehensive land use planning, functional planning, social delivery systems, and project planning methods. *(Studio/Sem.) Pre: 610 or permission of instructor.* Foster and Galloway

612 Growth Management Strategies *(II, 3)* Advanced seminar in plan implementation in small communities. Emphasis on enabling legislation for non-metropolitan small towns including coastal communities, capital budgeting, fiscal impact, special districts, and area-wide relationships. *(Sem. 3) Pre: 610 and 611 or permission of instructor.* Galloway

620 Revitalization of Central Cities *(II, 3)* Advanced concentration course in central city planning. Focus on cities of the Northeast and their contextual problems: demography,

socioeconomic characteristics and resources; economic development, commercial redevelopment, gentrification, capital infrastructure, finance. *(Lec. 3) Pre: 501, 511, 525 or permission of instructor.* Staff

621 Policy Analysis in Urban Areas *(II, 6)* Advanced studio seminar concerning analyses required in central city planning. Policy planning approach emphasizing retrenchment. Emphasis on budgeting, cost/benefit, cost effectiveness analysis, evaluation, capital assessment, social and fiscal analysis. *(Studio/Seminar) Pre: 620 or permission of instructor.* Staff

622 Implementation of Urban Redevelopment *(II, 3)* Tools for urban economic development, including capital budgets, long-term financial analysis, leveraging, taxation, finance, tax abatement, industrial revenue bonds, user charges, and privatization of public services. *(Sem. 3) Pre: 620, 621, or permission of instructor.* Staff

630 (603) Comprehensive Planning Studio *(II, 6)* Applied team problem solving. Planning experience working with specific client or community emphasizing sequential process and group product. Project to include problem definition, conceptual design analysis, and oral/graphic presentations. *(Studio 6) Pre: 501, 511, 525, 523, or permission of instructor.* Hammerschlag

691, 692 Special Problems in Planning *(I or II, 1-6)* Advanced work, under the supervision of a member of the staff and arranged to suit the individual requirements of the student. Staff

693-698 Special Problems *(I or II, 1-6)* Advanced work, under the supervision of a member of the staff and arranged to suit the requirements of a group of students. Staff

Comparative Literature Studies

M.A.

Graduate Faculty

Coordinator: (French) Associate Professor Ira A. Kuhn, Ph.D., 1970, University of Kansas

Department of English
Professor Jordan Y. Miller, Ph.D., 1957, Columbia University
Professor Daniel D. Pearlman, Ph.D., 1968, Columbia University
Associate Professor James M. Marshall, Ph.D., 1961, Syracuse University
Associate Professor Clare M. Murphy, Ph.D., 1964, University of Pittsburgh
Associate Professor Ralph M. Tutt, Ph.D., 1966, Duke University
Assistant Professor Wilfred P. Dvorak, Ph.D., 1972, Indiana University
Assistant Professor Dorothy Jacobs, Ph.D., 1968, University of Michigan
Assistant Professor John R. Leo, Ph.D., 1972, Northwestern University
Professor Emerita Edna L. Steeves, Ph.D., 1948, Columbia University

Department of Languages
(Classics) Associate Professor Stanford E. Cashdollar, Ph.D., 1969, University of Illinois
(French) Professor Harold A. Waters, Ph.D., 1956, University of Washington
(French-Linguistics) Associate Professor Kenneth H. Rogers, Ph.D., 1970, Columbia University
(German) Associate Professor Otto Dornberg, Ph.D., 1966, Ohio State University
(German) Assistant Professor Marlene Benesch, Ph.D., 1979, Brown University
(Italian) Associate Professor Paschal Viglionese, Ph.D., 1969, Rutgers — The State University
(Portuguese) Associate Professor Gregory R. McNab, Jr., Ph.D., 1973, New York University
(Russian) Associate Professor Sona Aronian Ph.D., 1971, Yale University
(Spanish) Professor Lewis J. Hutton, Ph.D., 1950, Princeton University
(Spanish) Associate Professor Robert Manteiga, Ph.D., 1977, University of Virginia
(Spanish) Associate Professor Thomas D. Morin, Ph.D., 1975, Columbia University

Specializations

English language literatures (American, British, Irish, Scots), Classical, French (including Québecois and Black French literature), German, Italian, Portuguese, Russian, and Hispanic literatures.

Master of Arts

Admission requirements: GRE; B.A. degree; formal training or demonstrable competence in literature; high level of proficiency in one foreign language.

Program requirements: first literature, 9 credits; second literature, 6 credits (one of the literatures may be English); CLS 510; electives pertinent to a student's program of study to be approved by major professor and advisory committee; reading knowledge of a second foreign language; comprehensive examination; thesis option, 24 credits; non-thesis option, 30 credits, including 6 credits of independent study resulting in the production of extended essays.

CLS Courses
Comparative Literature Studies

450 Studies in Comparative Literature *(I or II, 3)*

510 Introduction to Comparative Literature *(I or II, 3)* Theoretical and practical concerns of comparative literature: its nature and scope, methods, bibliography, and special problems. *(Lec. 3) Pre: graduate standing or permission of department.* Viglionese

520 Literary Theory and Criticism *(I or II, 3)* Meta-criticism: literary criticism as theory and practice and the relationship between literary and critical discourse. *(Lec. 3) Pre: graduate standing or permission of department. May be repeated once with change of topic.* Staff

530 Approaches in Comparative Literature *(I or II, 3)* Study of theme/myth, movement/era, genre/forms in two or more literatures, or interrelations with other disciplines. *(Lec. 3) Pre: graduate standing or permission of department. May be repeated once with a change of topic. Fall 1982: Decadence in Literature and Visual Arts.* Leo (Eng.) *Fall 1983: Renaissance Humanism.* Murphy (Eng.)

597 Special Problems *(I and II, 1-6)* Group and/or individual investigation of special problems in comparative literature studies. Staff

599 Masters Thesis Research *(I and II, 1-6)* Number of credits is determined each semester in consultation with the major professor and the Comparative Literature Studies Advisory Committee. Staff

See other listings under English and Languages.

Computer Science

M.S.

Graduate Faculty

Acting Chairperson: Professor Edward J. Carney, Ph.D., 1967, Iowa State University
Associate Professor Leonard J. Bass, Ph.D., 1970, Purdue University
Associate Professor Frank M. Carrano, Ph.D., 1969, Syracuse University
Associate Professor Edmund A. Lamagna, Ph.D., 1975, Brown University
Associate Professor Roger G. Rajan, Ph.D., 1974, University of Nebraska
Associate Professor Jin W. Soh, Ph.D., 1974, Northwestern University
Associate Professor Nelson H. Weiderman, Ph.D., 1971, Cornell University
Adjunct Associate Professor Charles Arnold, Ph.D., 1976, Harvard University
Adjunct Associate Professor Daniel Viccione, Ph.D., 1971, University of Rhode Island
Professor Emeritus William J. Hemmerle, Ph.D., 1963, Iowa State University

Specializations

Data base systems, operating systems, statistical computations, simulation, numerical

analysis, artificial intelligence, programming languages, theory of programming, information retrieval, performance evaluation, theory of computation, computer-aided education, computer organization.

Master of Science

Admission requirements: bachelor's degree, including undergraduate training in computer science at least through assembly language, and mathematics through linear algebra and calculus of several variables; GRE, including advanced test in computer science, mathematics, or undergraduate major field, are required for admission.

Program requirements for all candidates:

1) A maximum of 6 credits toward the M.S. degree from CSC 411, 412, 413.

2) At least one course from CSC 500, 551, and two courses from CSC 502, 512, 540.

3) Two additional CSC courses at the 500 level or above, excluding CSC 591 and 599 (ELE 508 could be substituted for one of these courses).

Thesis option program requirements: a minimum of 24 credits (exclusive of thesis) including the above requirements, and a thesis.

Non-thesis option program requirements: a minimum of 30 credits including the above requirements, with at least 18 at the 500 level or above including one course with a substantial paper involving significant independent research. A candidate must also pass a written comprehensive examination.

Doctor of Philosophy

Please see the listing under Applied Mathematical Sciences on page 23.

CSC Courses
Computer Science

406 Microcomputer Applications Laboratory *(I or II, 3)*
411 Computer Organization and Programming *(I and II, 3)*
412 Operating Systems *(II, 3)*
413 Data Structures *(I, 3)*
416 Microcomputer Systems Architecture *(I or II, 3)*
491 Directed Study in Computer Science *(I and II, 1-3)*
492 Special Topics in Computer Science *(I and II, 3)*

500 Scientific Applications of Digital Computers I *(I, 3)* Algorithms, techniques, practical procedures for digital computers related to applications of numerical methods. Approximation methods, numerical quadrature, solution of differential equations, zeros of functions, optimization methods, error analysis. *(Lec. 3) Pre: 350 and permission of instructor.* Carrano

502 Theory of Algorithmic Languages and Compilers *(II, 3)* Formal description of procedure-oriented languages and the techniques used in translating algorithms written in these languages into computer programs. *(Lec. 3) Pre: credit or concurrent registration in 413.* Bass and Lamagna

505 Design of Digital Circuits
See Electrical Engineering 505.

512 Advanced Operating Systems *(I, 3)* Advanced analysis of monitor and executive systems. Several topics from 412 will be studied in greater depth, along with recent developments in the field. *(Lec. 3) Pre: 411 and 413.* Bass and Weiderman

515 Theory of Computation *(I, 3)* Formal examination of several abstract models of computing machines. Functions that can and cannot be computed on the various models are characterized. *(Lec. 3) Pre: 6 credits of CSC at the 300 level or above or permission of instructor.* Bass

525 (or IDE 525) Simulation *(II, 3)* Discrete simulation models. Comparison of discrete change simulation languages. Methodology including generation of random variates, design of simulation experiments for optimization, and validation of models and results. Selected applications. *Pre: 202, 6 credits of statistics.* Carney and Shao

535 Information Organization and Retrieval *(II, 3)* Construction and accessing of large data bases; document classification, retrieval, and evaluation techniques; automatic dictionary and thesaurus construction; natural language content analysis; question answering systems. *(Lec. 3) Pre: 413.* Weiderman

536 Database Management Systems *(II, 3)* Concepts and theory of structuring and managing large data systems; relational, hierarchical, and network approaches to database organization; security and integrity; comparative analysis and evaluation of existing systems. *(Lec. 3) Pre: 413.* Bass and Weiderman

540 Analysis of Algorithms *(I, 3)* Design and analysis of computer algorithms; inherent computational complexity. Fast algorithms for sorting and searching, properties of graphs and networks, polynomial and matrix calculations, computational geometry, and combinatorial optimization problems. *(Lec. 3) Pre: 413.* Bass and Lamagna

551 Scientific Applications of Digital Computers II *(II, 3)* Algorithms, techniques, and practical procedures for digital computers emphasizing linear computations and statistical applications. Monte Carlo methods. Matrix calculations, simultaneous linear equations, matrix inversion. Least square analysis, multiple regression. Characteristic value problems *(Lec. 3) Pre: 350.* Carrano

581 (or ELE 581) Artificial Intelligence *(I or II, 3)* Formal theories of human information processing. State-space representation and search. Problem-reduction representations. Predicate calculus for theorem-proving and problem-solving. Semantic information processing. Artificial intelligence programming languages. *(Lec. 3) Pre: permission of instructor.* Staff

582 Robotics
See Electrical Engineering 582.

583 Computer Vision
See Electrical Engineering 583.

591 Directed Study in Computer Science *(I and II, 1-3)* Advanced work in computer science conducted as supervised individual projects. *Pre: permission of department. S/U credit.* Staff

592 Special Topics in Computer Science *(I and II, 3)* Advanced topics of current interest in computer science. *(Lec. 3) Pre: permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Economics

M.A.

Graduate Faculty

Chairperson: Associate Professor James L. Starkey, Ph.D., 1971, Boston College
Professor Richard Hellman, Ph.D., 1967, Columbia University
Professor Elton Rayack, Ph.D., 1957, University of Chicago
Associate Professor Harold Barnett, Ph.D., 1973, Massachusetts Institute of Technology
Associate Professor Glenworth A. Ramsay, Ph.D., 1974, Boston College
Associate Professor Gilbert S. Suzawa, Ph.D., 1973, Brown University
Assistant Professor John P. Burkett, Ph.D., 1981, University of California, Berkeley
Assistant Professor Leonard P. Lardaro, Ph.D., 1979, Indiana University
Assistant Professor Arthur C. Mead, Ph.D., 1978, Boston College
Professor Emeritus Joel B. Dirlam, Ph.D., 1947, Yale University
Professor Emeritus Bernard Schurman, Ph.D., 1958, Columbia University

Specializations

Economic development, economic theory, industrial organization, international economics, money and banking, public finance, econometrics, mathematical economics. Combinations with business administration, public administration, community planning, computer science and statistics are available.

Master of Arts

Admission requirements: GRE (verbal and quantitative) and, normally, some undergraduate training in economics. Some training in mathematics and statistics is also desirable.

Program requirements: thesis or non-thesis option, 30 credit hours, including, for Track I, ECN 512, 527, 528, 575, 576, and 515 or 516 or thesis. This track is strongly advised for students desiring to pursue further studies in the mainstream of contemporary thought or to prepare themselves for professional work in business, government, and teaching at the university level. For Track II, ECN 512, 527, 528 and 515 or 516 or thesis. This track is available to students who prefer a wider range of courses and more freedom of choice. Track III is a terminal program in applied economics combined with training in an area of vocational or professional interest such as business administration, public administration, computer science or community planning. The programs in this track will be designed separately for each individual student but must include one course with a substantial paper requiring significant independent research. For all tracks, the remaining credit hours required to complete a 30-credit-hour program will be worked out with the major professor. Non-thesis option requires written comprehensive examination.

ECN Courses
Economics

401 Poverty in the United States *(I or II, 3)*
402 Urban Economics *(I or II, 3)*
403 Theory and Topics in the Economics of Crime *(I or II, 3)*
404 Political Economy of Inequality *(I or II, 3)*
464 Comparative Economic Systems *(I or II, 3)*

503 Development of the United States Economy *(I, 3)* Process of economic development, as illustrated by the economy of the United States. *(Lec. 3) Pre: 126, and either HIS 141, 142, or ECN 302, or permission of instructor.* Staff

512 History of Economic Analysis *(II, 3)* Advanced work on formative developments in economic thought from classical political economy to modern welfare economics. Emphasis on relationships between doctrines and their institutional setting. *(Lec. 3) Pre: permission of instructor.* Schurman

515, 516 Economic Research *(I and II, 1-3 each)* Independent research. *S/U credit.* Staff

527 Macroeconomic Theory *(I, 3)* Static and dynamic models of aggregate economic behavior developed and analyzed. *(Lec. 3) Pre: 327 and 375 or equivalent, or permission of instructor.* Mead

528 Microeconomic Theory *(I, 3)* Analytic tools of optimization. Neoclassical price and distribution theory. Linear programming and production theory. General equilibrium and welfare economics. *(Lec. 3) Pre: 328 and 375 or equivalent, or permission of instructor.* Rayack

532 Industrial Organization and Public Policy *(II, 3)* Theoretical and empirical analysis of structure of industrial markets; behavior and performance of business firms in the American economy; government-business relationship and its effect on formulation of public economic policy. *(Lec. 3) Pre: 337 or permission of instructor.* Dirlam

538 International Economics: Theory and Policy *(I or II, 3)* Theory of international trade and applications to current problems. *(Lec. 3) Pre: 327 and 328 or permission of instructor.* Suzawa

543 Public Finance and Fiscal Policy *(I, 3)* Analysis of private wants and public needs. Serves as introduction to a searching examination of such federal and federal-state fiscal problems as budgetary theory and procedures, tax theory, and reform. *(Lec. 3) Pre: 342 or permission of instructor.* Starkey

552 Monetary Theory and Policy *(II, 3)* Analysis of structure and functioning of monetary and banking systems; discussion of contemporary monetary theories; evaluation of monetary policies. *(Lec. 3) Pre: 334 or permission of instructor.* Barnett

566 Economic Planning and Public Policy in Developing Nations *(II, 3)* Resource and financial planning in public and private sectors of developing nations with emphasis on planning tools, allocation of domestic and foreign resources, and on national economic policies. *(Lec. 3) Pre: 327 and 363 or 464, or equivalent, or permission of instructor.* Suzawa

575 Introduction to Mathematical Economics *(I, 4)* Application of basic quantitative methods to economic analysis. Dynamic and static economic models will be studied with emphasis on obtaining solutions. *(Lec. 3, Lab. 2) Pre: 327, 328 and MTH 141 or permission of instructor.* Mead

576 Econometrics *(II, 4)* Application of statistics and mathematics to economic analysis. Implication of assumption required by statistical methods for testing economic hypotheses. Current econometric methods examined and discussed. *(Lec. 3, Lab. 2) Pre: 575 or equivalent, EST 408 or equivalent, or permission of instructor.* Ramsay

590 Principles of Economics *(I and II, 3)* Survey of micro- and macroeconomic theory. *(Lec. 3) Graduate credit for matriculated M.B.A. students only.* Staff

595 Problems of Modernization in Developing Nations
See Resource Economics 595.

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

628 Advanced Microeconomic Theory *(II, 3)* Neoclassical value and distribution theory. Theories of imperfect competition, general equilibrium theory, and dynamic analysis. *(Lec. 3) Pre: 527 and 528 or permission of instructor.* Staff

630 (or REN 630) Resource Analysis *(I, 3)* Development and application of welfare theory to natural resource use. Welfare concepts such as consumer surplus, producer surplus, and marginal cost pricing in policy decisions for agriculture and natural resources. *Pre: 628 or permission of instructor. In alternate years beginning in 1982-83.* Staff

676 (or REN 676) Advanced Econometrics *(I, 3)* A course covering the tools necessary for professional research in resource economics. Reviews the general linear model, but emphasis is on simultaneous equation models. Assumes a knowledge of introductory econometrics, statistical theory, and matrix algebra. *Pre: 576 or its equivalent.* Staff

690 National Income *(II, 3)* Advanced macroeconomic theory. *(Lec. 3) Pre: 126 or 590 or permission of instructor.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Economics - Marine Resources (Interdepartmental)

Ph.D. in Economics — Marine Resources

Please see listing under Resource Economics on p. 90.

Education

M.A.

Graduate Faculty

Chairperson: Professor John V. Long, Jr., Ph.D., 1971, Syracuse University
Director of graduate studies: Associate Professor Richard G. Nelson, Ph.D., 1972, University of Wisconsin

Adult Education
Professor William Croasdale, E.D., 1966, Teachers College, Columbia University
Professor Patricia M. Kelly, Ph.D., 1969, Ohio State University
Assistant Professor John Boulmetis, Ph.D., 1982, Ohio State University
Assistant Professor Mary Kalymun, Ph.D., 1982, Pennsylvania State University

Assistant Professor David S. Morton, Ph.D., 1976, Michigan State University

Counseling and Guidance
Professor Peter E. Maynard, Ph.D., 1969, State University of New York, Buffalo
Associate Professor Thomas J. Gunning, Ed.D., 1966, Boston University
Associate Professor Alfred C. Pascale, Ed.D., 1958, Boston University
Associate Professor Jerome A. Schaffran, Ph.D., 1971, University of Iowa

Educational Research
Professor John V. Long, Jr., Ph.D., 1971, Syracuse University
Professor Thomas R. Pezzullo, Ph.D., 1971, Boston College
Professor Richard F. Purnell, Ph.D., 1966, University of Texas
Associate Professor Jennifer C. Greene, Ph.D., 1976, Stanford University
Assistant Professor J. Lynn Griesemer, Ed.D., 1977, University of Tennessee
Assistant Professor Stephen P. Horwitz, Ph.D., 1976, Florida State University

Elementary Education
Professor William Kelly, Ed.D., 1965, Boston University
Professor Thomas P. Nally, Ph.D., 1953, Michigan State College
Associate Professor Wilma I. Nagel, Ph.D., 1966, University of Connecticut
Assistant Professor Richard E. Sullivan, Ph.D., 1971, University of Texas, Austin

Reading Education
Professor Marguerite Bumpus, Ed.D., 1969, University of Massachusetts
Professor Marion L. McGuire, Ph.D., 1968, University of Connecticut
Associate Professor Alan E. Farstrup, Ph.D., 1977, University of Minnesota

Science Education
Professor William Croasdale, Ed.D., 1966, Teachers College, Columbia University
Associate Professor Theodore M. Kellogg, Ph.D., 1971, Florida State University

Secondary Education
Professor William Croasdale, Ed.D., 1966, Teachers College, Columbia University
Professor Walter C. Heisler, Ed.D., 1956, Michigan State University
Professor John V. Long, Jr., Ph.D., 1971, Syracuse University
Professor Francis X. Russo, Ph.D., 1964, Boston University
Professor George H. Willis, Ph.D., 1971, The Johns Hopkins University
Associate Professor Barbara Brittingham, Ph.D., 1973, Iowa State University
Associate Professor Hilda A. Calabro, Ph.D., 1965, Boston College
Associate Professor William L. McKinney, Ph.D., 1973, University of Chicago
Associate Professor Richard G. Nelson, Ph.D., 1972, University of Wisconsin
Assistant Professor J. Lynn Griesemer, Ed.D., 1977, University of Tennessee

Enrollment of foreign students is limited; minimum TOEFL score of 600 is required.

The Master of Arts degree is offered in the following areas of study. Applicants should specify the area of specialization on the application form.

Adult Education

Admission requirements: MAT or GRE, teaching certificate or sound background in general education and/or social sciences, interview with program faculty.

Program requirements: thesis or non-thesis option. EDC 505, 529, 580 or 581, 582; 583 or 584; 585; and a minimum of 18 credit hours of education or other electives including six hours of thesis or non-thesis seminar. Non-thesis option requires written comprehensive examination. All courses are offered in late afternoon and/or evening.

Counseling and Guidance
(Administered by the Department of Human Development, Counseling and Family Studies)

Admission requirements: MAT or GRE, minimum of twelve semester hours in the behavioral sciences (to include background in developmental theory, personality theory, and abnormal psychology), and personal interview. Concentrations are available in agency counseling, elementary and secondary school counseling, higher education student affairs services, and gerontological counseling. Teacher certification required for school counseling.

Program requirements: thesis or field-work option. Minimum 36-credit-hour program. HCF 450, 551, 553, 554, 560, EDC 529 and thesis or HCF 580, 581. Additional hours planned with adviser. Non-thesis option requires written comprehensive examination.

Educational Research

Admission requirements: MAT or GRE, teaching certificate, strong background in mathematics or statistics.

Program requirements: thesis; EDC 503, 514 or 574, 529, 570 or 571, PSY 410, 434, 510, 520, and computer science elective.

Elementary Education

Admission requirements: MAT or GRE and teaching certificate, one year teaching experience or equivalent desirable.

Program requirements: thesis or non-thesis option. EDC 529; 570; 572 or 577; 21 to 24 hours of coursework including 3 hours of foundations, 3 hours of methods, 3 hours of free elective, 6 hours of thesis or non-thesis seminar and 3-6 hours taken outside of Education Department. Non-thesis option requires written comprehensive examination.

Reading Education

Admission requirements: MAT or GRE and teaching certificate, one year teaching experience or equivalent desirable.

Program requirements: thesis or non-thesis option. EDC 503; 529; PSY 434; 24 credit hours of courses approved for the preparation of reading specialists including a thesis or six credit hours of clinic or practicum experience, and one or more electives. Non-thesis option requires written comprehensive examination

Science Education

Admission requirements: MAT or GRE and teaching certificate, undergraduate major in science, interview with faculty.

Program requirements: EDC 529; 12-18 credit hours of education electives including six hours of thesis or non-thesis seminar and a minimum of 12 hours of science courses. Non-thesis option requires written comprehensive examination.

Secondary Education

Admission requirements: MAT or GRE and teaching certificate, one year's teaching experience desirable, undergraduate major in academic area of secondary education, interview with appropriate faculty.

Program requirements: thesis or non-thesis option. EDC 529; 571, 572 or 574; 3 hours of foundations; 6-12 credit hours of education courses including six hours for thesis or non-thesis seminar and a minimum of 12 credit hours in academic area. Non-thesis option requires written comprehensive examination.

For Home Economics Education program see listing on page 55.

EDC Courses
Education

401 Development and Utilization of Instructional Materials *(I and II, 3)*
402 The Education of Special Needs Students *(I and II, 3)*
403 History of Education *(I, 3)*
407 Philosophy of Education *(II, 3)*
410, 411 Seminar and Supervised Field Practicum in Education of the Aging *(I and II, 3 each)*
424 Teaching of Reading *(I and II, 3)*
435 (or WRT 435) The Teaching of Composition *(I and II, 3)*
461 The Learning Disabled Reader: Elementary *(I or II, 3)*
462 The Learning Disabled Reader: Secondary *(I or II, 3)*

478, 479 Problems in Education *(I and II, 0-3 each)*

480, 481 Problems in Reading/Learning Disabilities *(I and II, 0-3 each)*

501 Comparative Education in International Perspective *(I or II, 3)* Comparing foreign systems of education with particular emphasis on cultural developments and significant education experiences; sampling of national systems in Western Europe, USSR, Far East, East Africa, and South America. *(Lec. 3) Pre: senior or graduate standing.* Whitcomb

502 The Modern Curriculum Movement *(I, 3)* Development of recent thinking of American curriculumists. The nature of curriculum development analyzed through the traditionalist, social scientific, and reconceptualist schools of thought. *(Lec. 3)* Willis

503 Education in Contemporary Society *(II, 3)* Leading educators' responses to issues and challenges confronting American education. Emphasis upon identification and analysis of contemporary theories and practices reflecting relationship between characteristics of society and educational values. *(Lec. 3)* Russo, Willis

504 Adult Basic Education *(I and II, 3)* Teaching of adults whose educational level is below high school completion. Physical, social and psychological characteristics of disadvantaged adults and various techniques and materials useful in motivating and teaching them. *(Lec. 3) Pre: permission of instructor.* Staff

505 Principles and Practices of Leadership Development for Youth and Adult Programs *(I or II, 3)* Philosophy and interrelationships of vocational-technical and general education with extension education and other community educational agencies; leadership concepts and implications; methods and techniques for increasing the effectiveness of organizations. *(Lec. 3) Pre: permission of instructor.* Staff

509 Critique of Public Policy in Human Services and Education *(I and II, 3)* Use of ideological assumptions in formulating and developing interpretive, normative, and critical perspectives on recent public policy proposals in various areas of human services and education. *(Lec. 3) Pre: permission of department.* Willis, Calabro, Russo

510 Practicum in Incorporating Televised Media *(I, 3)* Students develop skills in scripting and producing educational television programs. Application of knowledge of directing video tapes. *(Lec. 1, Lab. 4) Pre: 401 or permission of department.* Hicks

511 Evaluation of Film and Recorded Material *(I, 3)* Theory and principles of basic educational film processes. History of educational motion pictures, social and cultural implications of film, and standards for its evaluation and use in the schools. *(Lec. 1, Lab. 4) Pre: 401 or permission of department.* Howard

512 Organization and Administration of Audiovisual Programs *(II, 3)* Organization and administration of media departments in public schools. Media design and logistics, facility design, finance, and organization. Planning in-service training programs. *(Lec. 2, Lab. 2) Pre: 401 or permission of department.* Staff

513 Research and Theory in Instructional Technology *(II, 3)* Research methodology in the field of media as it applies to education. Research designs including survey, descriptive, and experimental types evaluated. *(Lec. 2, Lab. 2) Pre: 401 or permission of department.* Howard

514 Current Trends in Elementary Education *(I, 3)* For teachers and administrators, the most effective use of instructional materials, media of communication, and personnel in elementary school. *(Lec. 3) Pre: 529 or permission of department. In alternate years, next offered 1983-84.* Nally

515 Discipline and Youth in Schools *(I or II, 3)* Seminar for teachers interested in classroom principles and techniques from research on discipline in public secondary schools. Will include dramatic role-playing by participants when feasible. *(Lec. 3) Pre: teaching certificate or permission of instructor.* Purnell

516 Teaching English as a Second Language to Adults *(II, 3)* Methods and materials for educators who teach English as a second language to adults. *(Lec. 3) Pre: permission of instructor.* Staff

520 Teaching of Arithmetic *(I, 3)* For the experienced teacher, examination of the principles underlying teaching of arithmetic in the elementary school, comprehensive survey of materials and methods available for the classroom teacher of arithmetic. *(Lec. 3) Pre: senior or graduate standing. In alternate years, next offered 1982-83.* Nally

521 Teaching Basic Reading to Adults *(I or II, 3)* Techniques for teaching basic reading skills to illiterate adults; diagnosis, methods, and materials. *(Lec. 3) Pre: 504 or permission of instructor.* Bristow

522 Microcomputer Applications in the Classroom *(I and II, 3)* Introduction to the use of microcomputers in elementary and secondary classrooms. History, current use, techniques for evaluating hardware and software, implementation issues, future developments. *(Lec. 3) Pre: senior or graduate level standing.* Kellogg, Long, Farstrup

528 Teaching Language Arts *(II, 3)* For the elementary school classroom teacher. Preparation, presentation, use, and evaluation of methods and materials for teaching the communications skills (emphasis on listening, speaking, and writing). *(Lec. 3) Pre: senior or graduate standing. In alternate years, next offered 1982-83.* Nagel

529 Foundations of Educational Research *(I and II, 3)* Analysis of the current major research approaches to educational problems with emphasis on interpreting published research involving the language of statistics. Functional skills in basic descriptive statistics needed prior to enrolling. *(Lec. 3)* Purnell

530 Qualitative Evaluation *(I or II, 3)* Qualitative methods of obtaining and using data to formulate descriptions, interpretations, and warranted judgments, with special attention to the evaluation of educational and social service programs. Critical, ethnographic, and phenomenological traditions considered. *(Lec. 3) Pre: permission of department.* Willis

534 Mathematics in the Secondary School *(II, 3)* Implementation of a modern mathematics program in the secondary school through a study of modern mathematics concepts, experimental programs, and instructional planning. *(Lec. 3) Pre: 15 credits in mathematics.* Croasdale

538 Teaching the Gifted and Talented *(I or II, 3)* Social, psychological, legal and educational issues related to identification, selection and instruction of gifted and talented students. *(Lec. 3) Pre: an undergraduate general psychology course, graduate standing, or permission of instructor.* Sullivan

539 Evaluation and Monitoring of Occupational Training Programs *(I or II, 3)* Evaluation and monitoring theory and practice for occupational training programs. Focus on development of systems for job training such as CETA, Vocational Education, and private sector programs. *(Lec. 3) Pre: 529 or permission of instructor.* Boulmetis

540 Learning Disabilities: Assessment and Intervention
See Psychology 540.

541 Reading in Secondary School Content Subjects *(I and II, 3)* Designed especially to help junior and senior high school teachers to cope with the reading problems in their subject areas. *(Lec. 3) Pre: 313 or permission of department.* Staff

542 Methods for Challenging the Gifted Reader *(I and II, 3)* Providing challenging activities for gifted readers through interrelating reasoning with visual arts (viewing) and language arts (listening, speaking, reading, and writing). *(Lec. 3) Pre: 538 or permission of instructor.* McGuire

544 Assessing Learning Disorders in Reading *(I, 3)* Types of learning disorders; informal, criterion-referenced, and standardized tests used; administration, analysis, and interpretation of results; practice in the case study approach; team approaches. *(Lec. 3) Pre: 568 or permission of department.* Staff

545 Strategies for Teaching the Learning Disabled Reader *(II, 3)* Federal and state guidelines; principles for teaching; strategies

based on task analysis and learning modalities; resource teacher models. *(Lec. 3) Pre: 578 or permission of department.* Staff

546, 547 Field Practicum in Reading *(I and II, 3 each)* Practical application of classroom management and selection of materials to meet individual needs in a classroom situation. *Pre: 424; enrollment in a non-degree certification program and concurrently teaching. Not for graduate program credit. (Lec. 3) In alternate years.* Staff

548 The Application of Secondary School Content Area Reading Skills *(II, 3)* Teacher participation in planning and implementing a developmental reading approach to subject matter reading areas. Emphasis on teaching reading skills necessary for student understanding of subject area materials. *(Lec. 3) Pre: 541 and actively teaching.* Staff

561 Analysis of Reading Disabilites *(I, 3)* Causes of reading difficulties and the administration of diagnostic reading tests. Emphasis on construction and use of informal tests and standardized measures. Practice in analyzing data from case histories and in making individual case studies. *(Lec. 3, Lab. 2) Pre: 424 and permission of instructor.* McGuire

562 Techniques in Remedial Reading *(II, 3)* Practices effective in teaching remedial reading in both the regular classroom and remedial clinics. Analysis of published materials. Methods of building new materials, discussion and demonstration of their practical application. *(Lec. 3, Lab. 2) Pre: 561 and permission of instructor.* McGuire

563 Reading Programs for the Disadvantaged *(I, 3)* Impact of the culture of the disadvantaged upon the child and his response to learning and the school, with special emphasis on reading and the adjustment of reading materials and methods to individual socioeconomic-cultural differences. *(Lec. 3) Pre: 424 or permission of instructor.* Bumpus

564 Beginning Reading Programs *(II, 3)* Analysis of various approaches to reading instruction (other than the basal method) including phonetic, linguistic, language arts, programmed, and other experimental systems. Current materials analyzed and classified. *(Lec. 3) Pre: 424.* Staff

565 Analysis and Evaluation of Current Research in Reading *(II, 3)* Concise analysis of the latest research in reading. Criteria for the evaluation of reading research data as it applies to both teacher and learner. Location and application of current research to reading programs. *(Lec. 3) Pre: 424 and permission of instructor. In alternate years, next offered 1983-84.* McGuire

566, 567 Practicum in Reading *(I and II, 3 each)* Supervised case studies, practicum, and seminar reports on an individual reading project at either elementary or secondary level. Lecture and/or laboratory. 120 hours plus seminar. *Pre: 562 and permission of instructor.* McGuire

568 Reading and Learning Disabilities *(I, II, 3)* This course, designed for classroom teachers and reading specialists, focuses on instructional strategies for meeting the reading needs of learning-disabled children. *(Lec. 3) Pre: 6 credits in reading or permission of instructor.* Staff

569 Middle School Curriculum *(SS, 3)* Current middle school curriculum organization and materials with emphasis on the flexibility and integration of various content areas for the transecent learner. *(Lec. 3) Pre: graduate standing.* Staff

570 Elementary School Curriculum *(II, 3)* Modern curriculum in the elementary school with emphasis on the needs of children. Covers language arts, social studies, science, arithmetic, and special subjects. *(Lec. 3) Pre: 503, 529 or equivalent. In alternate years, next offered 1983-84.* Staff

571 The Secondary School Curriculum *(II, 3)* Intensive study of basic principles and procedures utilized in developing curriculum materials. Emphasis given to content of all curriculum areas in junior and senior high schools. *(Lec. 3) Pre: 503, 529. In alternate years, next offered 1982-83.* Whitcomb

572 Cooperative Supervision *(I and II, 3)* Analysis of function, principles, and techniques of democratic cooperative supervision of teachers and other school officials. Application of these principles to supervisory problems of principals, heads of departments, special supervisors, and critic teachers. *(Lec. 3) This course meets certification requirements for Critic Teacher Certificate.* Heisler

574 Current Trends in Secondary Education *(I and II, 3)* Effective use of instructional materials, media of communication, and organization of personnel and current research. *Pre: 529, 571 or permission of department.* Staff

575, 576 Supervised Field Study and Seminar in Elementary or Secondary Education *(I and II, 3 each)* For non-thesis candidates. Lectures, seminars, and field work. Candidates plan and carry out a field study project approved by the instructor. The completed project report must be successfully defended during semester. *Pre: admission to a master's program in education and permission of instructor.* Staff

577 Organization and Administration in Elementary School *(I, 3)* Functions and duties of elementary school principals. *(Lec. 3) In alternate years, next offered 1983-84.* Nagel

580 Organizing and Administering Youth Programs *(I or II, 3)* Planning, organization, instruction, and supervision of youth programs. Includes vocational-technical and general education in their relationship to extension education and other community agencies. Youth guidance and psychological development emphasized. *(Lec. 3) Pre: 505 or permission of instructor.* Staff

581 Organizing and Administering Programs of Adult Education *(I or II, 3)* Planning, organization, instruction, and supervision of continuing education for adults in both vocational-technical and general education as conducted by extension education and other community agencies. *(Lec. 3) Pre: 505, or permission of instructor.* Staff

582 Curriculum Development in Vocational-Technical and Extension Education *(I, 3)* Principles and processes involved in the basic concepts affecting vocational-technical and extension education programs. Emphasis on planning, execution, and evaluation. *(Lec. 3) Pre: 580 or 581 or permission of instructor.* Staff

583 Analyzing Community Needs and Resources for Youth and Adult Programs *(I, 3)* Helps the student function effectively in the role of change agent in a community setting. Concepts of goals, change, power, and community will be considered in relation to the student's community experiences. *(Lec. 3) Pre: permission of instructor.* Staff

584 The Adult and the Learning Process *(I and II, 3)* Examination of the adult as a learner with emphasis on the factors that affect adult learning. *(Lec. 3) Pre: 581 or permission of instructor.* Staff

585 Seminar on Leadership for Youth and Adult Programs *(II, 3)* Students will participate in a non-structured group to observe the emergence of leadership and the effects of individual behavior on self and others. *(Lec. 3) Pre: open to program majors with permission of instructor.* Staff

586, 587 Problems in Education *(I and II, 0-3 each)* Advanced work for graduate students in education. Courses conducted as seminars or as supervised individual projects. *(Lec. or Lab.) Pre: permission of department. May be repeated for additional credit as problems and topics vary.* Staff

588, 589 Supervised Field Practicum and Seminar in Youth and Adult Education *(I and II, 3 each)* Leadership principles and practices applied in selected clinic systems. 200 clock hours of practicum are required in addition to the seminar. *(Lec. 2, Lab. 3) Pre: 582, 583, or 584 and 529, or permission of instructor.* Staff

591, 592 Problems in Reading/Learning Disabilities *(I and II, 0-3 each)* Advanced, individually planned work in reading instruction for graduate students, conducted as seminars and supervised individual projects. *(Lec. or Lab.) Pre: permission of department.* Staff

594 Organization and Supervision of Reading Programs *(II, 3)* Various roles of the reading specialist in relation to the other line-staff personnel. Problems concerning the orientation of new teachers, reading research

and development, in-service programs, and community support. *(Lec. 3) Pre: 562. In alternate years, next offered 1983-84.* Staff

595 Workshop on the Use of the Newspaper in the Classroom *(SS, 1)* Brings together teachers who are particularly interested in the use of the newspaper in teaching, can profit from instruction in this technique, and will not only use the newspaper in their instruction, but will also stimulate its use among their associates. Speakers include members of the working press and URI faculty members. *Pre: elementary through high school teachers from Rhode Island and Connecticut schools.* Doctor

596 Organization Development in Education
See Human Development, Counseling and Family Studies 562.

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

ADE Courses
Adult and Extension Education

487 The Cooperative Extension Service in Today's Society *(II, 3)*
488 Methods and Materials for Adult Extension Education *(I, 3)*
489 Utilization of Paraprofessionals in Adult and Extension Education *(I, 3)*
491, 492 Special Problems in Adult Education *(I and II, 1-3 each)*

575 Adult and Cooperative Extension Programming for Older Adults *(I, 3)* Designing and conducting programs that will meet the learning needs of older adults. Useful for persons working with older adults in a variety of institutional settings. *(Sem. 3)* Jones

RDE Courses
Resource Development Education

444 (or EDC 444) Teaching Agribusiness and Natural Resources *(I, 3)*
486 Internship *(I and II, 1-6)*

Electrical Engineering

M.S., Ph.D.

Graduate Faculty

Chairperson: Professor Louis L. Scharf, Ph.D., 1969, University of Washington, Seattle
Professor John R. Birk, Ph.D., 1970, University of Connecticut
Professor Robert S. Haas, M.S., 1965, Northeastern University
Professor Leland B. Jackson, Sc.D., 1970, Stevens Institute of Technology
Professor Robert B. Kelley, Ph.D., 1967, University of California, Los Angeles
Professor Gabriel Lengyel, Ph.D., 1964, University of Toronto
Professor Allen G. Lindgren, Ph.D., 1963, University of Connecticut
Professor Shmuel Mardix, Ph.D., 1969, University of Jerusalem
Professor Shashanka S. Mitra, Ph.D., 1957, University of Michigan
Professor Charles Polk, Ph.D., 1956, University of Pennsylvania
Professor Alexander D. Poularikas, Ph.D., 1965, University of Arkansas
Professor Angaraih G. Sadasiv, Ph.D., 1963, Purdue University
Professor John E. Spence, Ph.D., 1962, University of Wisconsin
Professor Donald W. Tufts, Sc.D., 1960, Massachusetts Institute of Technology
Associate Professor James C. Daly, Ph.D., 1967, Rensselaer Polytechnic Institute
Associate Professor William J. Ohley, Ph.D., 1976, State University of New York, Stony Brook
Assistant Professor Jean-Daniel Dessimoz, Ph.D., 1980, Federal Institute of Technology, Lausanne, Switzerland
Assistant Professor Steven M. Kay, Ph.D., 1980, Georgia Institute of Technology
Adjunct Professor Karl E. Karlson, Ph.D., 1952, University of Minnesota
Adjunct Associate Professor Pranab K. Banerjee, Ph.D., 1971, University of Rhode Island
Adjunct Assistant Professor William V. McCullough, Ph.D., 1976, University of Rhode Island
Adjunct Assistant Professor Albert S. Most, M.D., 1962, The Johns Hopkins University
Adjunct Assistant Professor David O. Williams, M.D., 1969, Hahnemann Medical College

Specializations

Acoustics and underwater acoustics: information processing in acoustic channels, music synthesis, speech processing, modeling of electro-acoustical devices.

Biomedical engineering: Physiological control systems, heart assist devices, physiologic systems modeling, medical instrumentation, medical diagnostic techniques, biological effects of electromagnetic radiation, pattern recognition applied to medicine, biological signal processing, computers in health care.

Computer engineering: microprogrammed systems, multi-processing, high-speed signal processing, pattern recognition and computer vision.

Digital signal processing: parameter estimation, prediction and filtering, detection, digital image processing, digital filter synthesis, applications of adaptive filtering, algorithmic design, VLSI design.

Electromagnetic wave propagation: tropospheric and ionospheric propagation, ELF noise.

Optical engineering: fiber optics, lasers, dielectric wave guides, detectors, optical information processing, nonlinear optics, X-ray techniques.

Robotics: Applications of digital techniques to visual acquisition, orientation, transportation, and placement of workpieces. Kinematics and design of robots. Digital image processing.

Solid state electronics: optical properties of non-metallic solids, characterization of amorphous semiconductors, laser-matter interaction; solar cells, heterojunction structures, photocathodes; performance analysis of displays, imaging devices (infrared to X-ray); crystallographic techniques for sub-micron X-ray lithography.

System theory: optimal control and nonlinear estimation, application of communication theory to novel imaging systems.

Master of Science

Admission requirements: GRE and B.S. in electrical engineering, engineering science, physics, mathematics, or computer science. Preparation in related fields such as aeronautical, civil, chemical, and mechanical engineering or in the life sciences may be acceptable.

Program requirements: thesis or non-thesis option. Individual programs are designed in accordance with the students' backgrounds and interests. Thesis or non-thesis option: minimum of 18 credit hours in electrical engineering or in other areas of science and engineering. Attendance at the departmental seminar (ELE 601/602) is required of all students in graduate residence. Programs of study require departmental and Graduate School approval. In the non-thesis option a written master's examination and one course involving significant independent research and a substantial paper are required.

Doctor of Philosophy

Admission requirements: GRE and M.S. degree or equivalent in electrical engineering, engineering science, physics, mathematics or computer science.

Program requirements: for the comprehensive examination, background in several of the following areas is required — linear and non-linear systems, communication and control systems, design of digital systems, electromagnetic theory and solid state physics. Most students find it essential to become thoroughly familiar with the application of digital computer techniques. Attendance at the departmental seminar (ELE 601/602) is required of all students in graduate residence. Dissertation research makes use of major modern laboratories in the listed areas of specialization.

General Information

Programs of study can be designed for people who are employed on a full-time basis.

ELE Courses
Electrical Engineering

401 Laser, Optical Systems and Communication *(I, 4)*
405 Digital Computer Design *(II, 3)*
417 Direct Energy Conversion *(II, 3)*
427 Electromechanical Devices *(I, 4)*
432 Electrical Engineering Materials *(II, 4)*
436 Communication Systems *(I and II, 3)*
443 Electronics II *(I, 5)*
444 Electronics III, Pulse and Digital Circuits *(II, 4)*
457 Feedback Control Systems *(I, 3)*
458 Systems Laboratory *(II, 3)*
481, 482 Biomedical Engineering Seminar I and II *(I and II, 1 each)*
484 Modeling of Physiological Systems *(II, 3)*
491, 492, 493 Special Problems *(I and II, 1 each)*
495 Electrical Engineering Practice I *(I, II or SS, 3)*
496 Electrical Engineering Practice II *(II, 6)*

501 Linear Transform Analysis *(I, 3)* Fourier and Laplace transform analysis of continuous-time systems, causality and spectral factorization, evaluation of inverse transforms, z-transform analysis of discrete-time systems, Hilbert transforms, discrete Fourier transforms, generalized transforms. *(Lec. 3)* Staff

502 Non-linear Systems Analysis *(I and II, 3)* Iteration and perturbation techniques, phase plane and state space concepts, Liapunov's direct method, stability criteria for non-linear systems. *(Lec. 3) Pre: 501 or equivalent.* Lindgren

503 (or MCE 503) Linear Control Systems *(I or II, 3)* State variable description of continuous and discrete-time systems, matrices and linear spaces, controllability and observability, pole placement methods, observer theory and state reconstruction, modern control systems design. *(Lec. 3) Pre: 313 or MCE 366 or equivalent.* Lindgren or Palm

504 (or MCE 504) Optimal Control Theory *(II, 3)* Quadratic performance indices and optimal linear control, frequency response properties of optimal feedback regulators, state estimation, separation theorem, optimal control of nonlinear systems, Pontryagin's minimum principle. *(Lec. 3) Pre: 503.* Lindgren

505 (or CSC 505) Design of Digital Circuits *(I, 3)* Design techniques for digital computers and controllers. Combinatorial and sequential circuits, minimization techniques, fast arithmetic circuits, memory and control circuits, floating-point hardware, Turing machines, coders and decoders, microprogramming, sequence generators. *(Lec. 3) Pre: 405 or equivalent.* Staff

506 Digital Signal Processing *(II, 3)* Digital representations of signals and noise, digital filtering and spectral analysis, design of digital circuits for signal parameter estimation and signal detection. *(Lec. 3) Pre: 501 and 509.* Tufts and Jackson.

508 Computer Architecture *(I and II, 3)* Hardware architecture of modern minicomputers and microcomputers. Instruction sets, memory organization, peripheral interfacing and control, bus structures, microprogramming, microcomputer systems, techniques for real-time operation, software aids and requirements. *(Lec. 3) Pre: 405 or CSC 311 or equivalent.* Staff

509 Systems with Random Inputs *(I or II, 3)* Discrete and continuous linear systems with random inputs. Introduction to random processes in the context of linear systems. Applications to detection, smoothing and prediction. *(Lec. 3) Pre: knowledge of differential equations, linear systems and transform methods.* Staff

510 Communication Theory *(II, 3)* Communication theory for discrete and continuous channels. Optimum receiver principles and signal design. Calculation of channel capacity and reliability functions, coded systems, channel models, modulation techniques, and performance. *(Lec. 3) Pre: 509.* Staff

511 Electromagnetic Fields *(I, 3)* Review of electrostatics and magnetostatics. Maxwell's equations, wave propagation in dielectric and conducting media. Boundary phenomena. Radiation from simple structures. Relations between circuit and field theory. *(Lec. 3)* Staff

513 Solar to Electric Energy Conversion *(II, 3)* Review of the theory of thermal radiation. Collection of radiant energy as heat and direct conversion to electricity. Concentration on photovoltaic solar cells. *(Lec. 3) Pre: 331 or equivalent. Permission of instructor.* Mardix

514 Microwave Electronics *(I or II, 3)* Electronic engineering at microwave frequencies, microwave circuit theory, impedance transformation and matching, passive microwave devices, microwave tubes, semiconductor microwave electronics, microwave masers parametric amplifiers. *(Lec. 3) Pre: 411 concurrently or permission of instructor.* Daly

515 Quantum Electronics *(I or II, 3)* Laser engineering and applications, interaction of radiation with atoms, optical resonators, electro-optic modulation, harmonic generation, parametric oscillation and frequency conversion, noise in laser amplifiers and oscillators. *(Lec. 3) Pre: PHY 341 or permission of instructor.* Daly, Lengyel

516 Planetary Electrodynamics *(I or II, 3)* Introduction to description and theory of natural electric and magnetic phenomena on the earth and in the solar system such as lightning, natural geomagnetic and interplanetary magnetic fields, origin and properties of ionospheres, the "solar wind" and natural radio noise. *(Lec. 3) Pre: permission of instructor.* Polk

520 Fourier Optics *(I or II, 3)* Application of Fourier analysis in optical imaging and data processing. Systems concepts are stressed. Scalar diffraction, lenses, coherent and incoherent imaging, spatial filtering and optical information processing, and holography. *(Lec. 3) Pre: 313 or an equivalent basic knowledge of Fourier analysis.* Staff

531 Solid State Engineering I *(I and II, 3)* Periodicity of solids; dielectric, thermal, optical, and electromagnetic properties of electronically interesting solids. *(Lec. 3) Pre: 331 or equivalent.* Staff

532 Solid State Engineering II *(I and II, 3)* Semiconductor physics, transport properties. Applications including solid state lasers, piezoelectric, ferroelectric, and magnetic devices. *(Lec. 3) Pre: 531 or equivalent.* Staff

535 Transistor Circuits *(I and II, 3)* Semiconductors, characteristics of junction transistors. Analysis and design of single and multistage amplifiers including feedback. High frequency considerations, applications to systems. *(Lec. 3)* Staff

536 Semiconductor Electronics *(I or II, 3)* Theory and technology of semiconductor devices. Junction, field effect, optoelectronic and microwave devices. Integrated circuits. *(Lec. 3) Pre: 331 or equivalent.* Sadasiv

538 Principles of Remote Sensing *(I or II, 3)* Theory and techniques of remote sensing including spaceborne photometry and radiometry. Applications selected from the following topics: planetary atmospheres, geology and earth resources, environmental problems. *(Lec. 3) Pre: 323, PHY 406, or permission of instructor.* Staff

542 Analog Filter Design *(I or II, 3)* Introduction to passive network synthesis. Analysis and design of active circuits and filters with operational amplifiers, generalized impedance converters, gyrators. Introduction to the design of thick-film hybrid microcircuits. *(Lec. 3) Pre: 444 or equivalent.* Staff

571 (or OCE 571) Underwater Acoustics I *(I, 3)* Wave equation, energy, pressure and particle velocity. Acoustic properties of the sea. Elementary sources, refraction, reflection, ray theory, normal modes and scattering, with emphasis on sound propagation in the ocean. *(Lec. 3)* Stepanishen

575 Electroacoustical Engineering I *(I and II, 3)* Theory and design of electroacoustic transmission channels and the psycho-acoustic aspects of their use for high-quality music transmissions. *(Lec. 2, Lab. 3) Pre: permission of instructor.* Staff

576 Electroacoustical Engineering II *(I and II, 3)* Storage of sound, studio-design and acoustical measurements. *(Lec. 2, Lab. 3) Pre: 575.* Staff

580 (or ASC 580 or PCL 580) Experimental Animal Techniques *(II, 3)* Aseptic surgical techniques on laboratory mammals. Proper selection of animal models for specific purposes. Standards for humane experimentation. Techniques applicable to research interests of students. *(Lec. 2, Lab. 3) Pre: ZOO 442 or permission of instructor.* Radovsky and DeFeo

581 Artificial Intelligence
See Computer Science 581.

582 (or CSC 582) Robotics *(I or II, 3)* Description, design, and control of industrial and research robots. Tactual and visual sensing systems. Computer control of manipulators. Object descriptions for manipulation. Obstacle avoidance. Applications. *(Lec. 3) Pre: knowledge of matrix algebra and Laplace transforms or permission of instructor.* Birk

583 (or CSC 583) Computer Vision *(I, 3)* Algorithms used to extract information from two-dimensional images. Picture functions. Template matching. Region analysis. Contour following. Line and shape descriptions. Perspective transformations. Three-dimensional reconstruction. Image sensors. Interfacing. Applications. *(Lec. 3) Pre: MTH 362 or equivalent.* Staff

584 (or EST 584) Pattern Recognition *(II, 3)* Random variables, vectors, transformations, hypothesis testing and errors. Classifier design: linear, non-parametric, approximation procedures. Feature selection/extraction: dimensionality reduction, linear and non-linear mappings, clustering, and unsupervised classification. *(Lec. 3) Pre: 509 and CSC 410 or introductory probability and statistics, knowledge of computer programming.* Kelley

585 Clinical Engineering *(I or II, 3)* Clinical training in engineering aspects of patient care. Technological problems of patient monitoring, diagnosis, and treatment. Computers in chemical analysis, cardiac catheterization, surgery, medical research. Course held at neighboring hospitals. *(Lec. 1, Lab. 6) Pre: one semester of residency in biomedical engineering graduate program, permission of department.* Staff

586 Biomedical Electronics I *(I, 3)* Measurement techniques in medical and biological research. Pressure, flow, and temperature transducers. Bioelectric potentials and electrodes. Signal conditioners and display systems. Electrical safety. *(Lec. 3) Pre: ZOO 345 or equivalent, knowledge of differential equations, senior or graduate standing.* Staff

587 Biomedical Electronics II *(II, 3)* Instrumentation systems in medical diagnosis and therapy. Cardiovascular, respiratory, and chemical measurements. Patient monitoring, computers in biomedical systems. *(Lec. 3) Pre: ZOO 345 or equivalent, knowledge of differential equations, senior or graduate standing.* Staff

588 Biomedical Engineering I *(I, 3)* Modeling of biosystems. Electrical properties of biological materials. Electrocardiography, vectorcardiography. Models of nerve propagation. *(Lec. 3) Pre: ZOO 345 or equivalent, knowledge of differential equations, senior or graduate standing.* Staff

589 Biomedical Engineering II *(II, 3)* Mechanical properties of biological materials. Application of ultrasound to medical diagnosis and treatment. Hemodynamics, pulmonary and renal dynamics. Artificial organs. *(Lec. 3) Pre: ZOO 345 or equivalent, knowledge of differential equations, senior or graduate standing.* Staff

591, 592 Special Problems *(I and II, 1-3 each)* Advanced work under supervision of a staff member. Arranged to suit individual requirements of student. Credits not to exceed a total of 6. Pre: *permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

601, 602 Graduate Seminar *(I and II, 1 each)* Seminar discussions including the presentation of papers based on research or detailed literature surveys. *(Lec. 1) Attendance is required of all students in graduate residence, but a maximum of 1 credit per year is allowed, no more than 2 credits for the entire period.* Staff

606 Digital Filter Synthesis *(I, 3)* Review of z-transforms and discrete-time systems, properties of digital-filter networks, design of finite and infinite-impulse-response filters, accuracy considerations for coefficients and data, hardware implementation, system examples. *Pre: 506 or equivalent.* Jackson

616 Advanced Topics in Electromagnetic Theory *(II, 3)* Electromagnetic theory of inhomogeneous and anisotropic media. Ferrite devices. Introduction to the theory of plasmas. Ionospheric radio propagation. *(Lec. 3) Pre: 511 or equivalent.* Daly or Polk

631 Electronics of Solids I *(I and II, 3)* Properties of conductors, semiconductors, and insulators from quantum mechanical principles. Band theory of solids, superconductivity, thermoelectricity. *(Lec. 3) Pre: PHY 570 or equivalent.* Mitra

632 Electronics of Solids II *(I and II, 3)* Extension of 631, directed toward the examination of theoretical concepts fundamental to solid state electronics. Topics in current research programs and selected from areas such as quantum electronics, transport properties in strong electric and magnetic fields, and superconductivity. *(Lec. 3) Pre: 631 or equivalent.* Mitra

637 Photo-Electronics I *(I, 3)* Optics, including photometry, radiometry, natural illumination, irradiance, luminance, radiance, temperature. Theory, analysis, and specifications of of photodetectors, scanners and associated systems. Direct-viewing image tubes, their components and electron optics. *(Lec. 3) Pre: 437 or equivalent.* Staff

651 Feedback Control Systems I *(I, 3)* Analysis of synthesis of complex control systems. Extension of feedback control theory to handle random disturbances, sampled data, and non-linearities. System optimization. *(Lec. 3) Pre: 457: or equivalent.* Staff

660 Advanced Topics in System Theory *(I or II, 3)* Seminar for advanced students. Selected topics of current research interest. Material will be drawn primarily from recent literature. *(Lec. 3) Pre: permission of instructor.* Staff

661 Estimation Theory *(I or II, 3)* Extraction of information from discrete and continuous data, best linear estimation, recursive estimation, optimal linear filtering, smoothing and prediction, non-linear state and parameter estimation, design and evaluation of practical estimators. *(Lec. 3) Pre: 503 and 509.* Staff

665 Modulation and Detection *(I or II, 3)* Advanced treatment of modulation and detection theory. Minimum meansquare error, maximum likelihood, and maximum posterior probability estimators. Applications to communications systems and to radar and sonar systems. *(Lec. 3) Pre: 510.* Kay or Tufts

670 Advanced Topics in Signal Processing *(I or II, 3)* Seminar for advanced students. Selected topics of current research interest. Material will be drawn primarily from recent literature. *(Lec. 3) Pre: 506 and 606.* Staff

672 (or OCE 672) Underwater Acoustics II *(II, 3)* Transducers, radiators and receivers, directivity (array structures), equivalent circuits, efficiency; piezoelectricity, magnetostriction, sonar principles, measurements and calibration. *(Lec. 3)* Stepanishen

691, 692 Special Problems *(I and II, 1-3 each)* Advanced work under supervision and a staff member. Arranged to suit individual requirements of a student. Credits not to exceed a total of 6. *Pre: permission of department.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

English

M.A., Ph.D.

Graduate Faculty

Chairperson: Professor Daniel D. Pearlman, Ph.D., 1968, Columbia University
Director of graduate studies: Associate Professor Wilfred P. Dvorak, Ph.D., 1972, Indiana University
Professor Mark I. Goldman, Ph.D., 1959, University of Minnesota
Professor Thomas A. Gullason, Ph.D., 1953, University of Wisconsin
Professor Don R. Kunz, Ph.D., 1968, University of Washington
Professor Allan H. MacLaine, Ph.D., 1951, Brown University
Professor Francis X. Mathews, Ph.D., 1964, University of Wisconsin
Professor Jordan Y. Miller, Ph.D., 1957, Columbia University
Professor Richard T. Neuse, Ph.D., 1959, Yale University
Professor Paul J. Petrie, Ph.D., 1957, State University of Iowa
Professor Nancy A. Potter, Ph.D., 1954, Boston University; L.H.D., 1967, University of Rhode Island
Professor Jules P. Seigel, Ph.D., 1965, University of Maryland
Professor Robert P. Sorlien, Ph.D., 1955, Brown University
Professor David C. Stineback, Ph.D., 1969, Yale University
Professor Tom H. Towers, Ph.D., 1971, Tulane University
Professor Sidney H. White, Ph.D., 1962, University of Southern California
Associate Professor Paul G. Arakelian, Ph.D., 1975, Indiana University
Associate Professor Walter L. Barker, Ph.D., 1966, University of Connecticut
Associate Professor Josie P. Campbell, Ph.D., 1972, Pennsylvania State University
Associate Professor Walter Cane, Ph.D., 1966, Vanderbilt University
Associate Professor Dorothy F. Donnelly, Ph.D., 1979, Brandeis University
Associate Professor Mathilda M. Hills, Ph.D., 1970, Duke University
Associate Professor Marilyn J. Malina, Ph.D., 1967, University of Virginia
Associate Professor James M. Marshall, Ph.D., 1961, Syracuse University
Associate Professor Thomas H. McCabe Ph.D., 1968, University of Wisconsin
Associate Professor Clare M. Murphy, Ph.D., 1964, University of Pittsburgh
Associate Professor R. B. Reaves, Jr., Ph.D., 1971, University of Wisconsin
Associate Professor Eric T. Schoonover, A.M., 1959, University of Michigan
Associate Professor M. Beverly Swan, Ph.D., 1977, Boston University
Associate Professor Ralph M. Tutt, Ph.D., 1966, Duke University
Assistant Professor Sally F. Burke, Ph.D., 1978, University of Connecticut
Assistant Professor Lois Cuddy, Ph.D., 1975, Brown University
Assistant Professor Dorothy Jacobs, Ph.D., 1968, University of Michigan
Assistant Professor John R. Leo, Ph.D., 1972, Northwestern University
Assistant Professor Celest A. Martin, Ph.D., 1979, University of Southern California
Assistant Professor William L. Mensel, Jr., Ph.D., 1974, University of Washington
Assistant Professor Robert A. Schwegler, Ph.D., 1977, University of Chicago
Professor Emeritus Warren D. Smith, Ph.D., 1948, University of Pennsylvania

Specializations

For the M.A. and for the Ph.D., all historical periods, genres, and major authors in British and American literature; Scots and Irish literature; linguistics; critical theory.

Master of Arts

Admission requirements: GRE and a minimum of 21 credits in English with a B average in all English courses.
Program requirements: 24 credits plus thesis (6 credits); *OR* 30 credits (including two 600-level seminars) plus a comprehensive examination based upon a departmental reading list.

Doctor of Philosophy

Admission requirements: GRE with advanced test (Literature in English) and M.A. in English or equivalent.
Program requirements: reading knowledge of one foreign language, unless waived by student's doctoral committee in consultation with director of graduate studies. 24 credits (including four 600-level seminars) plus 18 credits of dissertation research. Written comprehensive examination in four areas (various options available: historical periods, genres, major authors, cross-disciplinary studies). Oral comprehensive examination in area of specialization. At least one course must be taken in each historical period in which a student does *not* write a comprehensive examination (courses taken for the M.A. may fulfill this requirement).

ENG Courses
English

430 American English and its Dialects *(I,3)*
436 The Language of Literature *(II, 3)*
440 Literary Heritage of New England to 1860 *(I, 3)*
444 The American Writer and the Negro *(II, 3)*
446 Modern American Drama *(II, 3)*
447* Twentieth Century American Poetry *(I and II, 3)*
448* The Nineteenth Century American Novel *(I, 3)*
449* The Twentieth Century American Novel *(I and II, 3)*
454 Modern British and European Drama *(I, 3)*
455* Twentieth Century British Poetry *(I, 3)*
458* The British Novel *(I, 3)*
459* The British Novel of the 19th Century *(II, 3)*
460* The British Novel of the 20th Century *(II, 3)*
462 The Medieval and Modern Epic *(II, 3)*
468* The European Novel to 1850 *(I, 3)*
469* The European Novel After 1850 *(II, 3)*
470* Chaucer *(I, 3)*
472*, 473* Shakespeare *(I and II, 3 each)*
474* Milton *(II, 3)*
477 The Elizabethan Drama *(II, 3)*
478 English Drama of the Restoration and Eighteenth Century *(I, 3)*
485 American Authors *(I or II, 3)*
486 British Authors *(I or II, 3)*

510 Bibliography and Literary Research *(II, 3)* Use of descriptive and analytical bibliography, various modes of literary criticism, and other scholarly tools in the solution of literary research problems. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1983.* Reaves

530 History of the English Language *(I, 3)* Historical study of development of English syntax, sounds, vocabulary, and usage. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1982.* Mensel

531 History of Critical Theory *(II, 3)* Important critical theories from Aristotle to the twentieth century. Emphasis upon orientation of theories to various aspects of the literary situation. Some study of modern attitudes toward earlier critics. Open to graduate students and senior English majors. *(Lec. 3) Pre: graduate standing or permission of instructor.* Murphy

532 Modern Literary Criticism *(I, 3)* Dominant modes and schools of criticism exemplified by T. S. Eliot, T. E. Hulme, I. A. Richards, Edmund Wilson, John Crowe Ransom, and other important critics. Pertinent related literary works. *(Lec. 3) Pre: graduate standing or permission of instructor.* Goldman

535 Old English *(I, 3)* Introduction to the language and literature. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1982.* Mensel

536 Problems in Linguistics and Literature *(II, 3)* Recent developments in linguistics and their application to the study of literature. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1983.* Arakelian

*Not acceptable for graduate degree program credit in English.

540 Modern American Novel *(I, 3)* Important American novelists of the twentieth century with emphasis on major developments in ideas and techniques. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1983.* Marshall, Gullason and R. Tutt

545 Problems in American Realism and Naturalism *(I, 3)* Readings, discussions, and papers on stylistic, thematic, and philosophic issues relating to literary artists like Howells, James, Crane, Dreiser, Hemingway, and others. *(Lec. 3) Pre: graduate standing or permission of instructor.* Gullason

546 Problems in American Romanticism *(II, 3)* Major themes and works of such authors as Poe, Emerson, Thoreau, Hawthorne, Melville, Whitman, and others. *(Lec. 3) Pre: graduate standing or permission of instructor. Spring 1983: Twain and Melville.* Marshall

547 Early American Literature to 1800 *(II, 3)* Thorough examination of colonial and federal literature, some discussion of beginnings of Romanticism. Special attention to Taylor, Edwards, Franklin, Fremeau, and Charles Brockden Brown. *(Lec. 3) Pre: graduate standing or permission of instructor.* Schoonover and Marshall

548 American Poetry to 1900 *(II, 3)* Important colonial and nineteenth century American poets with emphasis on major trends in ideas and techniques. *(Lec. 3) Pre: graduate standing or permission of instructor.* Potter

549 Modern American Poetry *(I, 3)* In-depth study of several major American poets, such as Eliot, Pound, Frost, Stevens, Williams, and others; or of a school such as the Imagists, the Fugitives, and others. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1982.* Pearlman

550 Middle English Literature *(I or II, 3)* Selections from Middle English literature exclusive of Chaucer. Works by Malory, the Pearl Poet, Gower, the Wakefield Master, and others. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1983.* Campbell

551 The Metaphysical Poets *(I, 3)* Intensive analysis and interpretation of poetry of Donne, Herbert, Vaughan, Crashaw, and Marvell. *(Lec. 3) Pre: graduate standing or permission of instructor.* Sorlien

554 Modern British Poetry *(I, 3)* In-depth study of several major British poets, such as Yeats, Lawrence, Auden, Thomas, MacNeice, and others; or of a school such as the War Poets (WWI), and others. *(Lec. 3) Pre: graduate standing or permission of instructor.* Goldman and Mathews

555 Modern British Novel *(I, 3)* Important British novelists of twentieth century with emphasis on major trends in ideas and techniques. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1983.* Staff

556 English Literature of the Sixteenth Century *(I, 3)* Early humanism. Tudor poetry and its continental antecedents. Satire and translation. Elizabethan voyage literature. Writers chosen from More, Erasmus, Skelton, Wyatt, Surrey, Sidney, Spenser, Marlowe, Hakluyt, Lodge, Shakespeare, and others. *(Lec. 3) Pre: graduate standing or permission of instructor.* Murphy, Sorlien and Hills

557 English Literature of the Seventeenth Century *(I, 3)* Selected poets and prose writers, studied for their contribution to the dominant themes and modes of expression of the Stuart and Cromwellian eras. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1983.* Sorlien and Jacobs.

558 English Literature of the Eighteenth Century *(II, 3)* Intensive study of major and selected minor figures of the eighteenth century. Emphasis on verse and non-fiction prose, some attention to developments of the drama. *(Lec. 3) Pre: graduate standing or permission of instructor.* Kunz and Reaves

559 English Literature of the Romantic Period *(I, 3)* Selections from the major works and writers of the Romantic Movement. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1983.* Petrie, Seigel and Tutt

560 English Literature of the Victorian Period *(II, 3)* Selections from the major works and writers of the Victorian period. *(Lec. 3) Pre: graduate standing or permission of instructor.* Goldman and Seigel

561 Modern European Novel *(II, 3)* Major developments in European novel during twentieth century. Special attention to Proust, Mann, Kafka, Moravia, Silone, Lagerkvist, Malraux, and Camus. *(Lec. 3) Pre: graduate standing or permission of instructor.* Gullason

570 Anglo-Irish Writers *(II, 3)* The Celtic Renaissance as a literary movement, its importance and influence. AE, Lady Gregory, Joyce, O'Casey, O'Flaherty, Stephens, Synge, Yeats, and others. *(Lec. 3) Pre: graduate standing or permission of instructor.* Murphy

571 Problems in Chaucer *(I, 3)* Intensive study of selected aspects of Chaucer's achievements as a poet. Emphasis on *The Canterbury Tales. (Lec. 3) Pre: graduate standing or permission of instructor. Next offered fall 1983.* MacLaine, Malina, Mensel and Neuse

573 Problems in Shakespeare *(II, 3)* Primarily a discussion course, concentrating on plays and characters that offer most interesting problems for student analysis. Solutions by leading critics are examined. *(Lec. 3) Pre: permission of instructor.* Smith

574 The Scots' Poetic Tradition through Robert Burns *(II, 3)* Intensive study of the poetry of Robert Burns, Ferguson, Ramsay, and others who sparked the Scottish revival. *(Lec. 3) Pre: graduate standing or permission of instructor.* MacLaine

575 Modern Southern Literary Renaissance *(II, 3)* Comprehensive study of a major literary movement. Representative works by Faulkner, Wolfe, Warren, Williams, Porter, Welty, O'Connor, and others. *(Lec. 3) Pre: graduate standing or permission of instructor.* Gullason and R. Tutt

576 English Novel of the Eighteenth Century *(I, 3)* Selected novels of Defoe, Richardson, Fielding, Smollett, Sterne, and Austen, with consideration of major criticism and of disparate influences on the emergence of the novel. *(Lec. 3) Pre: graduate standing or permission of instructor.* Kunz and Reaves

577 English Novel of the Nineteenth Century *(II, 3)* Important British novelists of the nineteenth century with emphasis on trends in ideas and techniques of Victorian novelists. *(Lec. 3) Pre: graduate standing or permission of instructor. Next offered spring 1983.* McCabe

578 Problems in Milton *(II, 3)* Emphasis on the major poetic works. *(Lec. 3) Pre: graduate standing or permission of instructor.* Neuse

590 Selected Topics *(I and II, 3)* Selected topics in American and British literature and topics of special interest not covered by traditional department offerings. *(Lec. 3) Pre: graduate standing or permission of instructor. Fall 1982: Whitman and New England Transcendentalists.* Marshall, and *Creative Writing: Poetry.* Petrie. *Spring 1983: Fiction of World War II.* Goldman, and *Creative Writing: Fiction.* Potter

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee

600-level (seminar) courses: specialized topics, intensive readings, occasional lecture, and frequent presentation of ongoing research by students. A substantial research project required. Pre: permission of department.

640, 641 Seminar in American Literature before 1900 *(I and II, 3 each) Fall 1982: Hawthorne.* Towers

642, 643 Seminar in Modern Literature (American) *(I and II, 3 each) Fall 1982: Faulkner.* Tutt

650, 651 Seminar in English Literature of the Middle Ages *(I and II, 3 each)* Staff

652, 653 Seminar in English Literature of the Sixteenth Century *(I and II, 3 each) Elizabethan Literature.* Hills

654, 655 Seminar in English Literature of the Seventeenth Century *(I and II, 3 each)* Staff

656, 657 Seminar in English Literature of the Eighteenth Century *(I and II, 3 each) Fall 1982: Swift and Defoe.* Reaves

658, 659 Seminar in English Literature of the Nineteenth Century *(I and II, 3 each)* Staff

660, 661 Seminar in Modern Literature (English) *(I and II, 3 each) Fall, Literature since 1945.* Leo

670, 671 Seminar in Special Literary Problems *(I and II, 3 each)* Readings in literature which present special problems not addressed by traditional department offerings. Seminar topics may be offered from time to time based upon student request. *(Lec. 3) Form and Philosophy in Modern British and American Literature.* Cuddy

691, 692 Independent Graduate Study *(I and II, 3 each)* Advanced study of an approved topic, under the supervision of a member of the staff. *(Lec. 3) Pre: permission of department.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

WRT Courses
Writing

435 (or EDC 435) The Teaching of Composition *(I and II, 3)*

999 Methods of Teaching College Writing *(I and II, 0)* Materials and multiple methods of teaching writing on the college level. Required of teaching assistants who will teach in the College Writing Program unless waived by the director of English graduate studies, the supervisor of teaching assistants, and the director of the College Writing Program. Swan and Staff

Environmental Health Science

M.S.

Graduate Faculty

Program Director: Professor Leonard R. Worthen, Ph.D., 1957, University of Massachusetts
Assistant Professor Robert F. Weisberg, Ph.D., 1976, University of Texas, School of Public Health
Adjunct Professor Frederick A. Siino, M.S., 1981, University of Massachusetts

This interdisciplinary 36-credit program involves graduate faculty from the Colleges of Arts and Sciences, Engineering, Pharmacy, and Resource Development. Representative faculty from each of these colleges comprise a Steering Committee that supervises the program.

Specializations

Curriculum is designed to prepare people for working in public health laboratories. In addition to a core curriculum, students are able to specialize in such areas as microbiology, environmental engineering, or food chemistry.

Master of Science

Admission requirements: GRE, bachelor's degree in biology, chemistry, engineering, or allied field.

Program requirements: CVE 570, 571, 572 (2 of these 3 courses); EHS 562 (Interdisciplinary Seminar); EHS 563 (Public Health Administration); Biostatistics or a suitable substitute; FSN 432, 521 and MIC 412 or equivalent courses. Students are also required to take a course which involves an assigned project including a comprehensive written report and pass a master's written examination. A summer internship in an approved, cooperating laboratory, such as the Rhode Island State Department of Health, is required for those persons with very limited or no practical experience.

EHS Courses
Environmental Health Science

562 Interdisciplinary Seminar *(I, 3)* Topics in environmental health are examined in light of underlying general principles of economics, quantitative analysis, management, politics, and government. *(Sem. 3) Pre: permission of director or instructor.* Weisberg

563 Public Health Administration *(II, 3)* This course is intended to aid in the preparation of an administrative role in a public health department. It introduces the student to the complex problems in today's state and federal health agencies. Topics covered include decision making, program budgeting, and planning. *(Lec. 3) Pre: permission of instructor or director.* Weisberg

Experimental Statistics

M.S.

Graduate Faculty

Professor Edward J. Carney, Ph.D., 1967, Iowa State University
Professor Peter F. Merenda, Ph.D., 1957, University of Wisconsin
Professor Lewis T. Smith, Ph.D., 1962, Iowa State University
Associate Professor R. Choudary Hanumara, Ph.D., 1968, Florida State University
Associate Professor James F. Heltshe, Ph.D., 1973, Kansas State University
Associate Professor William D. Lawing, Ph.D., 1965, Iowa State University
Adjunct Associate Professor Daniel Viccione, Ph.D., 1971, University of Rhode Island
Professor Emeritus William J. Hemmerle, Ph.D., 1963, Iowa State University

Specializations

Linear models, experimental design, multivariate methods, statistical computations, sequential methods, non-parametric methods, sampling methods, industrial statistics, genetics, psychometrics, ecological statistics, biostatistics.

Master of Science

Admission requirements: bachelor's degree including the equivalent of MTH 141, 142 Introductory and Intermediate Calculus with Analytic Geometry; MTH 243 Calculus and Analytic Geometry of Several Variables; MTH 215 Introduction to Linear Algebra; CSC 201 Introduction to Computing; EST 409 Statistical Methods in Research I. GRE, including advanced test in mathematics or undergraduate field are required for admission.

Thesis option program requirements: a minimum of 24 credits (exclusive of thesis) including MTH 451, EST 412, either EST 501 or 502, and at least 9 additional credits selected from EST 500, 501, 502, 520, 541, 542, 550, 592, 611.

Non-thesis option program requirements: 33 credit hours of course work distributed as follows:

1) MTH 451, EST 412, and either EST 501 or 502.

2) At least 9 credit hours selected from: EST 500, 501, 502, 520, 541, 550, 592, 611.

3) At least 6 of the remaining credit hours must be at 500 level or above (exclusive of EST 591).

4) The above coursework must include at least one course that requires a substantial paper involving significant independent study.

5) Written comprehensive examination.

Doctor of Philosophy

Please see the listing under Applied Mathematical Sciences on page 23.

General Information

Programs of study can be designed for people who are employed on a full-time basis.

EST Courses
Experimental Statistics

407 Introductory Biostatistics *(I or II, 3)*
408 or 409 Statistical Methods in Research I *(I and II, 3)*
412 Statistical Methods in Research II *(II, 3)*
413 Data Analysis *(II, 3)*
491 Directed Study in Experimental Statistics *(I and II, 1-3)*
492 Special Topics in Experimental Statistics *(I and II, 3)*

500 Nonparametric Statistical Methods *(II, 3)* Rank and sign tests, permutation tests and randomization, run test, tests of goodness of fit, order statistics, estimation, and comparison with parametric procedures. Examples illustrating the applications of nonparametric techniques. *(Lec. 3) Pre: 408 or 409.* Lawing and Hanumara

501 Analysis of Variance and Variance Components *(I, 3)* Analysis of variance and covariance, experimental design models, factorial experiments, random and mixed models, estimation of variance components, unbalanced data. *(Lec. 3) Pre: 412.* Staff

502 Applied Regression Analysis *(I, 3)* Topics in regression analysis including subset selection, biased estimation, ridge regression, and non-linear estimation. *(Lec. 3) Pre: 412.* Staff

517 Small N Designs
See Psychology 517.

520 Fundamentals of Sampling and Applications *(II, 3)* Simple random sampling; properties of estimates, confidence limits. Sample size. Stratified random sampling; optimum allocation, effects of errors, and quota sampling. Regression and ratio estimates; systematic and multi-stage sampling. *(Lec. 3) Pre: 408 or 409.* Carney, Hanumara, and Lawing

532 (or ASC 532 or PSY 532) Experimental Design *(I and II, 3)* Application of statistical methods to biological and pyschological research and experimentation. Experimental situations for which various ANOVA and ANCOVA designs are most suitable. *(Lec. 3) Pre: 408 or 409 or equivalent.* Smith or Velicer

541 Multivariate Statistical Methods *(I, 3)* Review of matrix analysis. Multivariate normal distribution. Tests of hypotheses on means, Hotelling's T^2, discriminate functions. Multivariate regression analysis. Canonical correlations. Principal components. Factor analysis. *(Lec. 3) Pre: 412 or PSY 510.* Hanumara, Heltshe

542 Discrete Multivariate Methods *(II, 3)* Analysis of multidimensional categorical data by use of log-linear and logit models. Discussion of methods to estimate and select models followed by examples from several areas. *(Lec. 3) Pre: 412.* Hanumara

550 Ecological Statistics *(I, 3)* Application of statistical methodology to the following topics: population growth, interactions of populations, sampling and modeling of ecological populations, spatial patterns, species abundance relations, and ecological diversity and measurement. *(Lec. 3) Pre: 409 or permission of instructor.* Heltshe

576 Econometrics
See Resource Economics 576.

584 Pattern Recognition
See Electrical Engineering 584.

591 Directed Study in Experimental Statistics *(I and II, 1-3)* Advanced work in experimental statistics conducted as supervised individual projects. *Pre: permission of department. S/U credit.* Staff

592 Special Topics in Experimental Statistics *(I and II, 3)* Advanced topics of current interest in experimental statistics. *(Lec. 3) Pre: permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

610 Factor Analysis
See Psychology 610.

611 Linear Statistical Models *(I, 3)* Review of mathematical and statistical concepts. Multivariate normal distribution. Distribution of quadratic forms. Power of the F-test. Basic linear models: general linear hypothesis, regression models, experimental design models, variance component models, mixed models. *(Lec. 3) Pre: 501 or 502.* Carney

635 Response Surfaces and Evolutionary Operations
See Industrial Engineering 635.

Food Science and Nutrition

M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor Arthur G. Rand, Jr., Ph.D., 1964, University of Wisconsin
Professor Stanley M. Barnett, Ph.D., 1963, University of Pennsylvania
Professor James G. Bergan, Ph.D., 1970, University of Illinois
Professor Clinton O. Chichester, Ph.D., 1954, University of California
Professor Spiros M. Constantinides, Ph.D., 1966, Michigan State University
Professor Clifford J. Cosgrove, M.S., 1957, University of Rhode Island
Professor Henry A. Dymsza, Ph.D., 1954, Pennsylvania State University
Professor Mabel B. Goshdigian, M.S., 1960, University of Rhode Island
Professor Tung-Ching Lee, Ph.D., 1970, University of California, Davis
Professor Charles E. Olney, Ph.D., 1967, University of Connecticut
Professor Kenneth L. Simpson, Ph.D., 1963, University of California
Associate Professor Phyllis T. Brown, M.S,. 1955, University of Rhode Island
Associate Professor Marjorie J. Caldwell, Ph.D., 1972, Cornell University
Associate Professor Ruth E. Eshleman, Ed.D., 1975, Columbia University Teachers College
Associate Professor Chong Min Lee, Ph.D., 1974, University of Rhode Island
Associate Professor Murn M. Nippo, Ph.D., 1976, University of Rhode Island
Assistant Professor Leonard Gerber, Ph.D., 1980, University of Illinois
Assistant Professor Kenneth R. Stauffer, Ph.D., 1979, Rutgers — The State University
Adjunct Professor Teruhisa Katayama, Ph.D., 1949, University of Kyushu, Japan
Adjunct Professor Gerald Silverman, Ph.D., 1954, Cornell University
Adjunct Associate Professor Allan D. Beck, M.S., 1970, University of Rhode Island
Adjunct Associate Professor Richard J. Coduri, Jr., M.S., 1971, University of Rhode Island
Adjunct Assistant Professor Jeffrey L. Howe, M.S., 1972, University of Massachusetts

Specializations

Food science: seafood quality, preservation, and product development; safety, toxicology, and nutritional evaluation of food; carotenoid chemistry; pesticide chemistry; food engineering; biotechnology of enzyme utilization, microbial protein production, and recovery and utilization of food processing wastes.

Nutritional Science: vitamin A biochemistry; lipid and antioxidant biochemistry; nutritional status evaluation; life-cycle requirements; nutrition improvement programs; nutritional evaluation of seafood; aquacultural nutrition.

Master of Science

Admission requirements: GRE and bachelor's degree with adequate preparation in area of proposed study.

Program requirements: thesis; FSN 503, 511, 512; 6 credits from chemistry, biochemistry or physiology; 6 credits in food science (FSN 431 or 432, plus one 500-level course) or 6 credits, including one 500-level course, in nutritional science (FSN 441, 444, 456, 542, AVS 512, ASP 586). If the student has taken the designated courses as an undergraduate, alternate courses need not be in same area.

Doctor of Philosophy

Admission requirements: master's degree in a physical or biological science is normally required.

Program requirements: same as master's degree plus statistics (EST 532 or equivalent), 2 credits of seminar (FSN 511-512), and a special problem (FSN 591-592) under an advisor other than the major professor. Each candidate shall also gain teaching experience by teaching or assisting in at least one college level course. Qualifying examination is required for students admitted without a master's degree.

FSN Courses
Food Science & Technology, Nutrition and Dietetics

421 Food Analysis *(I, 4)*
431 Biochemistry of Food *(I, 3)*
432 Food Processing *(II, 3)*
433 Food Quality *(II, 3)*
434 Marine Food Processing *(I, 4)*
438 Food Chemistry Laboratory *(II, 3)*
441 Advanced Human Nutrition *(I, 3)*
444 Nutrition and Disease *(II, 3)*
447 (or CHE 447) Food Engineering I *(I, 4)*
451, 452 Field Experience in Food and Nutrition *(I and II, 1-3 each)*
456 Community Nutrition *(I, 4)*
461 Food Safety *(II, 3)*
491, 492 Special Projects *(I and II, 1-3 each)*

502 Advanced Experimental Foods *(I, 3)* Application of the principles of food science and technology in the development of food products, considering effective methods of preparation, processing, and preservation, and the control and evaluation of food product quality. *(Lab. 6) Pre: permission of department. In alternate years, next offered 1983-84.* C. Lee

503 Food Science and Nutrition Research Methods *(I, 4)* Theory and practice in techniques and methods as applied to research in food science and nutritional science. *(Lec. 1, Lab. 6) Pre: permission of department.* Simpson

505 Marine Foods Seminar *(I, 1)* Presentations specifically related to marine foods such as processing, preservation, nutritive value, and consumer acceptability. *(Lec. 1) Pre: graduate standing or permission of department.* Cosgrove

511, 512 Food Science and Nutrition Seminar *(I and II, 1 each) 511:* Reports and discussions of current topics in food science and nutrition. *512:* Oral presentations of thesis and dissertation research topics in progress. Attendance and registration are required of all graduate students in residence, but no more than two credits are allowed for a program of study. *(Lec. 1) Pre: graduate standing or permission of department.* Staff

521 Pesticide Chemistry *(II, 3)* Nomenclature, chemical and physical properties, mode of action, and methods of analysis of insecticides, fungicides and herbicides. *(Lec. 2, Lab. 3) Pre: organic chemistry. In alternate years, next offered 1982-83.* Olney

526 (or MCH 526) Lipid Chemistry *(I, 3)* Advanced course in the chemistry of biologically important lipids such as the fatty acids, neutral glycerides, phospholipids, steroids, and the chemistry and biochemistry of the carotenoids. *(Lec. 3) Pre: BCP 581. In alternate years, next offered 1983-84.* Olney, Simpson and Turcotte

531 Teaching of Nutrition
See Home Economics Education 531.

532 Seafood Quality *(II, 3)* Biochemical and microbiological deterioration of seafoods, methods utilizing these reactions for quality assessment, and processes to inhibit these reactions for preservation of fresh seafoods. *(Lec. 1, Lab. 4) In alternate years; next offered 1983-84. Pre: 421, 432 or permission of instructor.* Rand

542 Minerals and Vitamins *(II, 3)* Recent research in minerals and vitamins as related to human nutrition. Discusses the interrelationship between minerals, vitamins, and other nutrients as they relate to nutrition status. *(Lec. 3) Pre: 441 or permission of department. In alternate years, next offered 1983-84.* Gerber

548 Food Engineering II
See Chemical Engineering 548.

549 Food and Biochemical Engineering III
See Chemical Engineering 549.

575 Biochemical Engineering II
See Chemical Engineering 575.

591, 592 Special Research Problem *(I and II, 1-4)* Advanced work under supervision of a staff member. Arranged to suit individual requirements of students. *Pre: permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

691, 692 Research in Food Science and Nutrition *(I and II, 1-3 each)* Assigned research on an advanced level. Student is required to outline problem, conduct the necessary literature survey and experimental work, and to present his observations and conclusions in a report. Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

French
M.A.

See Languages on p. 58.

Geography
M.A.

Graduate Faculty

Chairperson: Associate Professor Lawrence Juda, Ph.D., 1973, Columbia University
Professor Lewis M. Alexander, Ph.D., 1949, Clark University
Professor Aloys A. Michel, Ph.D., 1959, Columbia University
Associate Professor Niels West, Ph.D., 1973, Rutgers — The State University
Assistant Professor Gerald H. Krausse, Ph.D., 1975, University of Pittsburgh
Assistant Professor Dennis W. Nixon, J.D., 1975, University of Cincinnati; M.M.A., 1976, University of Rhode Island
Instructor Bruce E. Marti, M.A., 1975, Florida Atlantic University

Specializations

Marine geography; techniques of cartographic analysis.

Master of Arts

Admission requirements: GRE. The advanced examination in geography is not required, but candidates should have, or be prepared to make up without graduate credit, the equivalent of 12 credits of introductory work in physical geography (or earth science), cultural, economic, and political geography. Another 15 credits in related social or natural sciences are desirable as are introductory courses in cartography and computer science.

Program requirements: thesis and, normally, GMA 421, 502, 591 or 592.

For courses, see Marine Affairs, page 62.

Geology
M.S.

Graduate Faculty

Chairperson: Professor J. Allan Cain, Ph.D., 1962, Northwestern University
Professor John J. Fisher, Ph.D., 1967, University of North Carolina
Professor O. Don Hermes, Ph.D., 1967, University of North Carolina
Associate Professor Jon C. Boothroyd, Ph.D., 1974, University of South Carolina
Associate Professor Reinhard K. Frohlich, Ph.D., 1966, University of Clausthal-Zellerfeld
Associate Professor Eugene J. Tynan, Ph.D., 1962, University of Oklahoma

Specializations

Coastal geomorphology: analysis and mapping of coastal processes and land-forms using field techniques, remote sensing aerial and satellite imagery. Emphasis on Rhode Island barrier beaches, Cape Cod, and barrier islands of Atlantic coast.

Sedimentation: emphasis on field projects. a) Measurement of Recent beach and estuarine processes and investigation of facies. b) Recent braided streams and alluvial fans. c) Depositional systems of ancient rocks.

Glacial geology: sedimentary aspects of Pleistocene and Recent glacial geology of New England and Alaska; environmental mapping.

Petrology – geochemistry: field and laboratory petrologic studies in southeastern New England and elsewhere, including petrogenesis of volcanic, plutonic, and metamorphic rocks.

Geohydrology: analysis of geologic factors affecting groundwater quantity and quality, utilizing geologic and hydrologic mapping, subsurface geoelectric and surface-flow field surveys for glacial, bedrock and coastal studies.

Applied geophysics: gravity and magnetics related to structural and plutonic geology in southern New England. Near-surface geophysics such as geoelectrics, gravity, and refraction seismic for groundwater and related topics.

Palynology: taxonomy, morphology, and stratigraphic distribution of various plant and animal microfossils — such as spores, pollen, archaeomonads, silicoflagellates, hystrichosphaerids, etc. Also, studies in modern and Quaternary spores and pollen.

Planetary geology: origin and history of chasms, channels, and valleys of Mars.

Remote sensing: Applied remote sensing using optical instrument analysis of satellite imagery and aerial photography in geomorphology, coastal, structural, extraterrestrial, and environmental geology.

Resource and environmental studies: relevant aspects of the above specializations.

Individual programs may include courses and/or research in conjunction with the Graduate School of Oceanography and other departments; interdisciplinary studies are encouraged.

Master of Science

Admission requirements: GRE and bachelor's degree in science or engineering. By the end of the first year, students lacking an undergraduate major equivalent of the bachelor of science degree in geology will be required to demonstrate, through coursework and/or qualifying examinations, comparable knowledge of geology and related fields.

Program requirements: thesis, oral comprehensive examination, departmental seminar (for no program credit), defense of thesis.

GEL Courses
Geology

401 Ore Deposits *(II, 3)*
410 Geomorphology *(I, 4)*
422 Intermediate Mineralogy—Petrology *(I, 3)*
440 Introduction to Paleontology *(I, 4)*
450 Introduction to Sedimentation and Stratigraphy *(I, 4)*
465 Introduction to Geophysics *(I, 3)*
475 Geology of Petroleum *(II, 3)*

510 Coastal Geomorphology *(II, 3)* Coastal development and interpretation in relation to endogenetic and exogenetic shore processes. Experimental model wave tank studies and applied field studies. *(Lec. 3) Pre: 410, 450, or permission of instructor. Offered in spring of odd calendar years.* Fisher

515 Glacial Geology *(I, 3)* Investigation of late Cenozoic glaciation including areas with presently existing glaciers. Primary stress on sedimentology and geomorphology of glacial deposits. Field trips in New England area. *(Lec. 2, Lab. 2) Pre: 450 or permission of instructor. Offered in fall of even calendar years.* Boothroyd

525 Advanced Mineralogy and Petrography *(I, 3)* Crystal-chemical relationships of the petrologically important mineral groups and advanced petrographic study (including U-stage methods) of textures, and mineral reactions. *(Lec. 2, Lab. 2) Pre: 321 or permission of instructor. Offered in fall of odd calendar years.* Hermes

527 Analytical Geochemistry *(II, 3)* Fundamentals and principles of rapid chemical analyses of geological materials. Application of atomic absorption spectroscopy, selected gravimetric methods, and miscellaneous techniques currently used in student research. *(Lec. 1, Lab. 6) Pre: CHM 212 and senior status, or permission of instructor.* Hermes

530 Igneous Petrology *(II, 3)* Tectonic and chemical bases for igneous phenomena stressing the association concept of igneous activity. Evaluation of the criteria used in petrogenetic interpretations. *(Lec. 2, Lab. 3) Pre: 321 or permission of instructor. Offered in spring of even calendar years.* Hermes

531 Metamorphic Petrology *(II, 3)* Facies concept and other methods of interpreting metamorphic mineral assemblages. Chemical and fabric changes during metamorphism, including principles of structural petrology. *(Lec. 2, Lab. 3) Pre: 321 or permission of instructor.* Cain

541 Animal Micropaleontology *(I, 3)* Concentrated study of animal microfossils with primary emphasis on taxonomy, morphology, ecology, and stratigraphic occurrence. *(Lec. 2, Lab. 3) Pre: 440 or permission of instructor. Offered in fall of even calendar years.* Tynan

542 Plant Micropaleontology *(II, 3)* Concentrated study of plant microfossils with primary emphasis on taxonomy, morphology, ecology, and stratigraphic occurrence. *(Lec. 2, Lab. 3) Pre: 541 or permission of instructor. Offered in spring of odd calendar years.* Tynan

550 Sedimentary Processes *(II, 3)* Physical and chemical processes of sedimentation with emphasis on fluvial, beach, and estuarine environments. Stress on field applications of theory, with independent project and reading. *(Lec. 3) Pre: 450 or permission of instructor. Offered in spring of odd calendar years.* Boothroyd

553 Basin Analysis *(II, 3)* A depositional systems and facies model approach to interpretation of sedimentary rocks. In-depth study of various ancient depositional basins using models developed from recent sedimentary environments. Field trips. *(Lec. 3) Pre: 450 or permission of instructor. Offered in spring of even calendar years.* Boothroyd

555 Biostratigraphy *(I, 3)* Principles and methods used to analyze and interpret areal and time relationships of stratified rocks and history of life contained in the rocks. *(Lec. 2, Lab. 3) Pre: 440 and 450 or permission of instructor. Offered in fall of odd calendar years.* Tynan

565 Advanced Interpretation in Applied Geophysics *(II, 3)* Interpretation of geophysical data using theoretical models. Reflection, refraction, and surface propagation of seismic energy. Computer analysis of gravity and magnetic potential data. D.C. geoelectrical potential over horizontally stratified medium. *(Lec. 2, Lab. 2) Pre: MTH 243, PHY 214, GEL 465 or equivalent course in physics with permission of instructor. Offered in spring of odd calendar years.* Frohlich

566 Seismology and Plate Tectonics *(II, 3)* Earthquakes, intensity and magnitude determination, fault plane solution; earth's interior, crustal and upper mantle structure related to plate boundaries. Seismic zones and margins of tectonic plates. Earthquake control and prediction. *(Lec. 2, Lab. 3) Pre: MTH 142, PHY 214, GEL 465, or equivalent course in physics or mathematics with permission of instructor. Offered in spring of even calendar years.* Frohlich

585 Geohydrology *(II, 3)* Ground-water hydrology and drainage basin analysis related to geomorphology, glacial geology, and environmental impact. Analysis of water resources in various geologic environments. Geophysical methods of investigation. *(Lec. 3) Pre: 302 or 410 and 450 and permission of instructor. Offered in spring of even calendar years.* Fisher

590 Special Problems *(I and II, 1-3)* Advanced work under the supervision of a

member of the staff arranged to suit the individual requirements of the student. *(Lec. and/or Lab. according to the nature of the problem) Pre: permission of instructor.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Note: for other related courses see OCG 540, 544, 545, 625, 628, 629, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 678, 681 and CVE 587, 588.

Gerontology

Director: Professor Donald L. Spence, Ph.D., 1965, University of Oregon

The gerontology program blends a strong and comprehensive gerontological background with the various professional skills offered in five University master's degree programs. It is designed to prepare professional practitioners to serve their older clients with a high level of excellence and understanding. The program is limited to 15 new students annually with acceptance into one of the following degree programs as a prerequisite: Child Development and Family Relations, Education (Adult Education, and Counseling and Guidance); Home Economics Education; Physical Education; Textiles, Clothing and Related Art. Please see the listing of the above programs to determine admission and program requirements.

Although scholarship and interest in the problems of aging are primary factors in considering applicants, every effort will be made to choose students from various disciplines for each entering group. Each student is expected to develop a thorough understanding of four basic areas:

1. The processes of aging in the human being, including physiological and psychomotor changes and the psychological effects of those processes on the individual;
2. The social setting in which the aging individual lives and operates and the consequences of his interaction with this environment;
3. The overall organization of society including extended family structures and the private and state agencies which serve the aging specifically or which deal with elderly clients as part of a larger population served;
4. The prevailing cultural ideologies, including persistent myths and stereotypes of aging, and how these collective beliefs influence the quality of life of the aged.

In addition to the program requirements listed under the participating degree program, specialization requirements include: SOC 438 Aging in Society; HCF 520 Developmental Issues in Later Adulthood; a third course to be taken within the student's individual degree program which addresses the issues of aging in relation to the skills or knowledge of that discipline. Each student must also participate in a common practicum seminar and complete at least six credit hours of the research or practicum requirement specified in the program requirements for the participating department.

History

M.A.

Graduate Faculty

Chairperson: Professor Robert M. Gutchen, Ph.D., 1966, Columbia University
Director of graduate studies: Assistant Professor Gino Silvestri, Ph.D., 1969, Syracuse University
Professor Josiah M. Briggs, Ph.D., 1962, Columbia University
Professor Joel A. Cohen, Ph.D., 1967, University of Connecticut
Professor James F. Findlay, Jr., Ph.D., 1961, Northwestern University
Professor Chong Sun Kim, Ph.D., 1965, University of Washington
Professor Maurice N. Klein, Ph.D., 1965, Emory University
Professor William D. Metz, Ph.D., 1945, University of Wisconsin
Professor Sharon H. Strom, Ph.D., 1969, Cornell University
Professor Robert G. Weisbord, Ph.D., 1966, New York University Graduate School
Associate Professor Anthony T. Bryan, Ph.D., 1970, University of Nebraska
Associate Professor Frank Costigliola, Ph.D., 1973, Cornell University
Associate Professor Richard A. Roughton, Ph.D., 1971, University of Maryland
Associate Professor Gary Thurston, Ph.D., 1973, Columbia University
Assistant Professor Burton G. Brown, Jr., Ph.D., 1973, Boston University
Assistant Professor Charles E. Daniel, Jr., Ph.D., 1968, Ohio State University
Assistant Professor Michael W. Honhart, Ph.D., 1972, Duke University
Adjunct Associate Professor Albert T. Klyberg, Ph.D., 1967, University of Michigan

Specializations

History of the United States; history of Europe; Third World area studies. These three areas of specialization include courses in: American, diplomatic, East Asian, African, black, Latin American and women's history; imperialism; history of science; modern English history; early modern and modern European history; state and local history.

In addition to the courses listed in this catalog, the History Department offers many courses at the 300 level which deal with subject matter that may be of value to graduate students not only in history, but in other disciplines as well. In such cases, the graduate student may register for HIS 502 (if the 300-level course deals with European history), HIS 536 (for American history), or HIS 588 (Third World history). The student will audit the lectures of the 300-level course and, in addition, will meet in tutorial sessions with the lecturer, in order to pursue the topic at greater depth. These 500-level tutorial courses may be repeated for different 300-level courses in each area but no more than five of these tutorials will be permitted in a graduate program. Arrangements must be made with the instructor at the beginning of the semester. For a listing of the 300-level courses, see the *Undergraduate Bulletin.*

Master of Arts

Admission requirements: GRE (advanced test desirable) and bachelor's degree with at least 24 credits in history. Majors in related fields may be admitted with permission of the department.

Program requirements: thesis option (30 credit hours) to include four courses at 500 level, at least one of which must be a colloquium and one must be a seminar; non-thesis option (30 credit hours) to include five courses at the 500 level, at least one of which must be a colloquium and two must be seminars. Both options require a four-hour written examination and an oral examination. Two courses in a related field are allowed.

Cooperative Program (M.A. and M.L.S.)

By proper selection of coursework, a student may earn simultaneously the degrees of Master of Arts in history and Master of Library Science.

Admission requirements: GRE (advanced test desirable) and other requirements listed for history and library science. Applicant must apply and be accepted in both programs. Applications (in quadruplicate) should indicate History/Library Science as the field of specialization.

Program requirements: student must submit individual 30-credit (minimum) programs of study for each degree that satisfy specific core requirements for these programs. Since a maximum of six credits of coursework may be jointly used to satisfy degree requirements, a minimum of 54 credits total is required to satisfy the requirements for both degrees.

HIS Courses
History

451 Historical Society and Museum Administration *(II,3)*
455 American Maritime History *(SS, 3)*
491 Conference on the Social Studies *(SS, 3)*

501 Colloquium in European History *(I or II, 3)* Intensive study of major interpretative works in European history. *(Lec. 3) Pre:*

graduate or senior standing, permission of department. Staff

502, 503 Special Readings in European History *(I and II, 3 each)* Intensive tutorial work, research, and readings in European history. *Pre: graduate standing and permission of instructor. Concurrent audit of parallel 300-level course required. May be repeated.* Staff

521, 522 Readings and Research in European History *(I and II, 3 each)* Intensive study of selected topics in European history. With permission of the department, this course may be taken twice for credit. *(Lec. 3) Pre: graduate or senior standing, permission of department.* Staff

535 Colloquium in American History *(I or II, 3)* Intensive study of major interpretative works in American history. *(Lec. 3) Pre: graduate or senior standing, permission of department.* Staff

536, 537 Special Readings in American History *(I and II, 3 each)* Intensive tutorial work, research and readings in American history. *Pre: graduate standing and permission of instructor. Concurrent audit of parallel 300-level course required. May be repeated.* Staff

540 Seminar in American Colonial History: the Seventeenth and Eighteenth Centuries *(I or II, 3)* Intensive research on selected topics in the Colonial period of American history. *(Lec. 3) Pre: permission of department.* Staff

541 Seminar in Nineteenth-Century American History *(I and II, 3)* Intensive research on selected topics in the broad period between adoption of the Constitution and World War I. *(Lec. 3) Pre: permission of department.* Staff

542 Seminar in Twentieth-Century United States History *(I and II, 3)* Intensive research on selected topics in United States history since 1900. *(Lec. 3) Pre: permission of department.* Staff

543 Seminar in the History of the United States Foreign Relations *(II, 3)* Research in the history of the U.S. foreign relations since 1775. All aspects of foreign relations, including both internal and external factors and historiographical problems will be considered. *(Lec. 3) Pre: permission of instructor.* Costigliola

550 Seminar in Black Nationalism and the International Race Problem *(I or II, 3)* Examination of the historical roots of black nationalism in the United States and the international implications of racial conflicts in selected areas of the world. *(Lec. 3) Pre: permission of instructor.* Weisbord

560 Research in Local History *(II, 3)* Directed research in secondary and primary materials on topics of interest to the individual. *(Lec. 3) Pre: 141 and 142.* Metz

580 Colloquium in Latin-American History *(I or II, 3)* Intensive study of major interpretative works in Latin-American history. *(Lec. 3)* Bryan

588, 589 Special Readings in Third World History *(I and II, 3 each)* Intensive tutorial work, research, and readings in Third World history. *Pre: graduate standing and permission of instructor. Concurrent audit of parallel 300-level course required. May be repeated.* Staff

591 Directed Study or Research *(I and II, 3)* Directed readings, research, or study designed to meet the particular needs of individuals or small groups of graduate students. Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Home Economics Education

M.S.

Graduate Faculty

Chairperson: Professor John V. Long, Jr., Ph.D., 1971, Syracuse University
Professor Patricia S. Kelly, Ph.D., 1969, Ohio State University
Assistant Professor Mary Kalymun, Ph.D., 1982, Pennsylvania State University

Specializations

Innovative practices in methods and teaching techniques; curriculum deveopment with specialization in middle school, secondary, adult, recurrent, consumer, and nutrition education; teacher education and supervision; gerontology.

Master of Science

Admission requirements: bachelor's degree with a concentration in home economics education or a related home economics subject area; GRE with advanced test in education.

Program requirements: for thesis option (30 credits): HED 506, 509, 507 or EDC 582, HED elective, research methods course, basic knowledge of statistics, four-hour written comprehensive examination, and two-hour oral defense of thesis.

For non-thesis option (36 credits): HED 506, 509, 507 or EDC 582, HED elective, research methods course, four-hour written comprehensive examination, action research project, and oral presentation of action research project.

Other courses may be chosen in accordance with student's background, interests, and needs. Courses may be selected in an allied field such as adult or extension education or in a subject matter area of home economics.

General Information

This program, leading to the Master of Science degree, allows individuals flexibility in the selection of courses to meet their needs and interests. Personalized plans of study with an emphasis on instruction, curriculum, supervision, and research can be developed around a thesis or action research option.

A student may elect a secondary concentration in an associated home economics area such as textiles and clothing, child development and family relations, nutrition, consumer affairs, gerontology, education, or adult education.

The home economics education program also offers courses to meet the Rhode Island certification requirements for a permanent teaching certificate. Thirty-six credits or an M.S. are required within six years of receiving one's Provisional Secondary Certificate in Home Economics.

HED Courses
Home Economics Education

478, 479 Problems in Home Economics Education *(I and II, 1-3 each)*
482 Field Experience *(I and II, 1-3) S/U*
483 Teaching Alternatives *(I, 8) S/U*
490 Teaching Home Economics: Grades 1 through 6 *(II, 2)*
491 Teaching Home Economics: Adults *(II, 3)*
495 Teaching Occupational Home Economics *(I or II, 3)*

506 Instructional Communications *(I or II, 3)* Selection, organization, and use of instructional materials, methods, and techniques for effective home economics teaching in a formal or informal educational setting. *(Lec. 3) In alternate years.* Kelly

507 Curriculum Development *(I or II, 3)* New developments in curriculum planning as related to organization and administration of comprehensive and occupational home economics and other vocational programs; evaluation as it relates to an effective program. *(Lec. 3) Pre: one year teaching experience or permission of instructor. In alternate years.* Kalymun and Kelly

508 Supervision of Student Teachers *(I or II, 3)* For teachers desiring to supervise students preparing for provisional certificates in agriculture, business, distributive education, or home economics. Meets requirements for a Critic Teacher Certificate in the areas listed. *(Lec. 3) Pre: at least one year teaching experience and permission of department. In alternate years.* Kelly and May

509 Seminar in Home Economics Education *(I or II, 3)* Study of current trends and issues as they affect home economics education; critical study of research literature and techniques appropriate to solution of problems. *(Lec. 3) In alternate years.* Kelly

531 (or FSN 531) Teaching of Nutrition *(I or II, 3)* Development of curriculums in nutrition education for teachers in grades K-12 and appropriate programs for community nutrition educators. Emphasis on innovative teaching techniques using latest nutrition knowledge. *(Lec. 3) Pre: graduate standing and permission of department.* Dymsza and Staff

532 (or CNS 532) Consumer Education *(II, 3)* Curriculum development in consumer problems for teachers in grades K-12 and for adult education. Application of current consumer information and issues through the use of innovative teaching strategies. *(Lec. 3) Pre: CNS 320, HED 334 or its equivalent and permission of instructor.* Kalymun and Lown

586, 587 Problems in Home Economics Education *(I and II, 3 each)* Advanced work for graduate students in home economics education. Conducted as seminars or as supervised individual projects. *(Lec. or Lab.) Pre: permission of department.* Staff

595 Masters Project: Action Research *(I and II, 1-6)* Candidates plan and carry out an action research project approved by the instructor. Number of credits is determined each semester in consultation with major professor. A maximum of six credits is allowed. *Pre: admission to a master's program in home economics education, a course in research methods and permission of instructor.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

CNS Courses
Consumer Studies

401 Consumer and Managerial Problems of Families with Special Needs *(II, 3)*
420 Consumer Protection *(I, 3)*
422 Current Consumer Topics *(II, 3)*
470 Special Problems *(I and II, 2-4)*

532 Consumer Education
See Home Economics Education 532.

570 Special Problems *(I, 3)* Advanced study to be selected from areas of home management theory and its application, work simplification, family economics, and equipment. *(Lab. TBA)* Staff

Industrial Engineering
M.S.

Graduate Faculty

Chairperson: Associate Professor David M. Shao, Ph.D., 1970, State University of New York, Buffalo
Professor Charles F. James, Jr., Ph.D., 1963, Purdue University
Professor D. Edward Nichols, Ph.D., 1958, Purdue University
Associate Professor William D. Lawing, Jr., Ph.D., 1965, Iowa State University
Assistant Professor Lester W. Garber, Ph.D., 1979, Pennsylvania State University
Assistant Professor Thirumalaiswan Radhakrishnan, Ph.D., 1980, University of Wisconsin, Madison

Specializations

Operations research: mathematical programming, stochastic processes, queuing theory, simulation, networks, applied statistics and probability, optimization, combinational models.

Production systems: quality control, reliability, inventory systems, sequencing and scheduling theory, production functions, forecasting, line balancing, manufacturing systems.

Materials processing: processing of materials, metrology, tool material research, NC, CAD/CAM, adaptive control of processing systems.

Other: health systems, industrial-ocean engineering.

Note: Most of the industrial engineering graduate courses are scheduled early in the evening to accomodate students who are employed on a full-time basis.

Master of Science

Admission requirements: GRE and B.S. degree in industrial engineering. An applicant with a B.S. degree in another field of engineering, or in mathematics, physics, chemistry, or computer science will be considered; generally such applicants will be required to complete some deficiency courses.

Program requirements: thesis or non-thesis option. One course each in operations research and computer science, two courses in probability-statistics, or equivalent. Non-thesis option requires a major paper involving significant independent research and a written comprehensive examination.

Doctor of Philosophy

Please see the listing under Applied Mathematical Sciences on page 23.

Special Financial Aid

Research assistantships, part-time professional employment in local industries and hospitals.

IDE Courses
Industrial Engineering

404 Engineering Economy *(I, 3)*
411 Engineering Statistics I *(I, 3)*
412 Engineering Statistics II *(II, 3)*
422 Production Facilities Design *(II, 3)*
430 Design and Analysis of Compensation Systems *(II, 3)*
432 Operations Research I *(I, 3)*
433 Operations Research II *(II, 3)*
435 Introduction to Operations Research *(I and II, 3)*
440 Materials Processing and Metrology I *(II, 3)*
491, 492 Special Problems *(I and II, 1-6 each)*

500 Network Application in Industrial Engineering *(II, 3)* Industrial systems problems that can be formulated in terms of flows in networks. Critical path scheduling, transportation problems, allocation, sequencing, line balancing, etc. *(Lec. 3) Pre: 432 and permission of instructor. In alternate years.* Shao

510 Human Factors *(II, 3)* Analytic relationships between man and his working environment. Design of equipment, facilities, and environmental controls to meet the capabilities and limitations of the human being. *(Lec. 3) Pre: permission of instructor.* Staff

513 Statistical Quality Control *(I, 3)* Topics in statistical quality control systems. Single, multiple, and sequential sampling. Design and analysis of a wide variety of statistical control systems used in conjunction with discrete and continuous data, for several kinds of data emission. *(Lec. 3) Pre: 412 or equivalent.* Nichols

514 Special Topics in S.Q.C. *(I, 3)* Quality control evaluation and monitoring systems for short-run production processes; analysis of critical specifications in small limited sample opportunities; sequential analyses; statistical procedures for trouble shooting; small sample strategies. *(Lec. 3) Pre: 412 or equivalent or permission of instructor.* Nichols

517 Applied Control Theory in Industrial Engineering *(I, 3)* Complex control mechanisms will be studied and applied to production and manufacturing operation. Automatic control systems for production and manufacturing will be designed and analyzed. *(Lec. 3) Pre: 404, MTH 244 and permission of instructor.* Staff

520 Material Handling *(I, 3)* Development of principles for engineering design and evaluation of equipment to move industrial materials in and between processes, including chemical and physical characteristics of material to be handled, rates of material flow, queuing, and economics. *(Lec. 3) Pre: MCE 263, CVE 220, IDE 404.* Staff

525 Simulation
See Computer Science 525.

533 Advanced Statistical Methods for Research and Industry *(I, 3)* Estimation and testing; regression and correlation; analysis of variance and related topics. Applications in industrial operations and engineering research. *(Lec. 3) Pre: 411 or permission of instructor.* James

535 Industrial Reliability Engineering *(II, 3)* Theories of reliability applicable to the design and operations of manufacturing processes and product quality assurance control systems. Quantitative analyses of economic specifications, performance levels, maintenance levels, and redundancy systems. *(Lec. 3) Pre: permission of instructor.* Nichols

540 Production Control and Inventory Systems *(I, 3)* Theory and practice of industrial production control and inventory systems. A broad spectrum of mathematical models for static, dynamic, perpetual, and periodic inventory systems as they affect and relate to production. *(Lec. 3) Pre: permission of instructor.* Staff

541 Materials Processing and Metrology II *(I, 3)* Continuation of 440. Engineering analyses in the processing of materials. Dynamic coupling, tool-work-piece interaction, energy and thermal analysis; mechanics of material removal and displacements, advanced topics in mechanical electrical systems for processing of materials. *(Lec. 3) Pre: 440 or permission of instructor.* Staff

545 Manufacturing Engineering: Design, Analysis, Synthesis *(II, 3)* Production and logistic systems, quantitative models introduced in and applied to congestion problems, industrial planning, control, scheduling, other problem areas of the industrial enterprise. *(Lec. 3) Pre: 350 or permission of instructor.* Nichols

550, 551 Advanced Topics in Probabilistic Operations Research I and II *(I and II, 3 each)* Concepts of simple random processes and their application in the analysis of industrial problems. Random walk, branching processes, recurrent events, discrete and continuous Markov chains, birth and death models and their application to inventory, replacement, reliability, and waiting line problems. *(Lec. 3) Pre: 411, MTH 215, or equivalent.* Staff

555, 556 Engineering Applications of Mathematical Programming I and II *(I and II, 3 each)* Sensitivity analysis and pricing problems, practical problems in degeneracy and duality, decomposition methods for large-scale systems, applied convex, integer, nonlinear and quadratic programming methods. An introduction to stochastic programming. *(Lec. 3) Pre for 555: 432 and permission of instructor; for 556: 555 and permission of instructor. In alternate years.* Staff

565 Theory of Scheduling *(II, 3)* Sequencing problems, finite sequencing for a single machine n/m job shop problems with analytical and heuristic procedures, networks applied to scheduling, queuing systems in scheduling, probabilistic scheduling problems. Survey of selected literature. *(Lec. 3) Pre: permission of instructor. In alternate years, next offered 1983-84.* Shao

570 Operations Research Modeling in Health Care *(II, 3)* Introduction to major areas of application of operations research in health care systems; emphasis on modeling and other analytical techniques used in hospitals, ambulatory care centers, planning and regulatory agencies, and health systems research organizations. *(Lec. 3) Pre: 435 and EST 409 or equivalent.* Staff

591, 592 Special Problems *(I and II, 1-6 each)* Advanced work under supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. or Lab. according to the nature of the problem) Credits not to exceed a total of 12. Pre: permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

610 Topics in Applied Queuing Theory *(I, 3)* Poisson and Erland queues, imbedded chains, M/G/1 and G/M/1 queues, and related topics in queuing theory. Analysis of a wide variety of queues with an applications orientation. *(Lec. 3) Pre: 433 or permission of instructor. In alternate years, next offered 1983-84.* Staff

634 Design and Analysis of Industrial Experiments *(II, 3)* Further development of topics in analysis of variance. Randomized blocks, Latin squares and related designs, factorial experiments, confounding and fractional replications, and split-plot designs. Design and analyses of engineering experiments. *(Lec. 3) Pre: 533.* Lawing

635 (or EST 635) Response Surfaces and Evolutionary Operations *(II, 3)* Methods of determining the response surface for multiple factors over a specified range and techniques for seeking an optimum. First and second order response surfaces. Rotatable second order design. Central composite rotatable designs. Multivariable EVOP programs and other topics in evolutionary operations. *(Lec. 3) Pre: 533 or equivalent.* Lawing

642, 643 Advanced Topics in the Processing of Materials I, II *(I or II, 3 each)* Extensive studies of contemporary and classical research in material processing. Systems study of problems of processing modern materials and technological achievements in processing. *642: Metallic materials. 643: Nonmetallic materials. (Lec. 3) Pre: 541 or permission of instructor. In alternate years, next offered 1983-84.* Staff

657 Geometric and Dynamic Programming *(II, 3)* Basic concepts of geometric programming, the duality theorem, approximation and limiting techniques. Nature of dynamic programming, deterministic and stochastic sequential decision problems. Lagrange multipliers in both geometric and dynamic programming. *(Lec. 3) Pre: 555. In alternate years, next offered 1983-84.* Shao

660 Methods of Optimization *(II, 3)* Methods of optimization: indirect, direct elimination, climbing. Geometric programming. Problems and other topics in applied optimization. *(Lec. 3) Pre: CSC 500 and permission of instructor. In alternate years, next offered 1983-84.* Staff

691, 692 Advanced Special Problems in Industrial Engineering *(I and II, 1-6 each)* Advanced work under the supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problems) Credits not to exceed a total of 12. Pre: permission of department.* Staff

International Studies

International studies are represented by international orientations in many graduate programs as well as by the specialized programs described below. Inquiries concerning international orientations available through the various combinations of electives within existing degree programs may be addressed to the department in which the student plans to enroll or to the Dean of the Graduate School. Further information may also be obtained from Theodore A. Suddard, director for International Student Affairs, and Melvin K. Hendrix, director of African and Afro-American Studies.

Specializations

Master of Arts in Political Science with International Relations Specialization. The Department of Political Science offers over 20 courses in international relations and area studies enabling students to fashion programs suitable to their special interests. To insure an interdisciplinary approach, the department encourages students to take up to 12 credits of relevant course offerings in economics, history, geography, or sociology. For requirements, see Political Science.

Graduate Certificate Program in International Development Studies. A five-course, 15-credit program leading to a Graduate Certificate awarded by the Dean of the Graduate School is offered in each spring semester by the Departments of Economics, Geography, Political Science, and Resource Economics. African and Afro-American Studies and the Department of Sociology and Anthropology also participate in certain aspects of this program, which is designed to provide a supplemental, interdisciplinary

concentration on the problems and processes of modernization and international development.

Admission requirements: GRE and master's degree or equivalent, or concurrent enrollment in a master's program in one of the participating fields.

Program requirements: interdisciplinary core seminar (REN 595 — Problems of Modernization in Developing Countries); two specialized seminars selected from PSC 510, ECN 566, REN 430; 3 credits of directed study selected from PSC 556, ECN 515, 516, REN 491, 492, or GMA 591, 592; and 3 credits of approved elective. When the graduate certificate is pursued concurrently with a master's degree, the certificate credit requirements must be taken in addition to all requirements for the master's degree. Completion of the master's degree program is required to receive the certificate.

Development concentration option within master's degree: the graduate programs in economics, geography and marine affairs, political science, resource economics, and sociology offer master's candidates an option in international development. Students electing this option as part of their M.A. program are required to take the International Development Core Seminar (595) and six credits of related electives.

Requests for further information and for application forms should be directed to the Dean of the Graduate School. Initial inquiries should indicate in which of the above disciplines and from which institution the applicant holds the master's degree, or whether he or she is interested in pursuing the master's degree at this University concurrently with the graduate certificate program, and where his or her particular research interests lie. Such information will assist the administering committee in selecting an adviser for the student and in designing a program adapted to his or her needs. Assistantships or scholarships are not available for participants in the graduate certificate program as such, but may be held by students who are concurrently enrolled in one of the participating master's programs.

LANGUAGES

The University offers Master of Arts degrees in French and Spanish.

Graduate Faculty

Chairperson: Associate Professor Stanford C. Cashdollar, Ph.D., 1969, University of Illinois

French section head: Associate Professor Joseph G. Morello, Ph.D., 1968, University of Missouri

Professor H. Dorothy Rothschild, Ph.D., 1959, Columbia University

Professor Harold A. Waters, Ph.D., 1956, University of Washington

Associate Professor Armand B. Chartier, Ph.D., 1970, University of Massachusetts, Amherst

Associate Professor Jean S. Hyland, Ph.D., 1959, University of Kansas

Associate Professor Ira A. Kuhn, Ph.D., 1970, University of Kansas

Associate Professor Kenneth H. Rogers, Ph.D., 1970, Columbia University

Associate Professor Constantin Toloudis, Ph.D., 1969, Rice University

Professor Emeritus Lambert C. Porter, Docteur és lettres, 1953, University of Paris, University of Toulouse

Spanish section head: Associate Professor Robert Manteiga, Ph.D., 1977, University of Virginia

Director, graduate program: Professor Lewis J. Hutton, Ph.D., 1950, Princeton University

Associate Professor Thomas D. Morin, Ph.D., 1975, Columbia University

Associate Professor Michael Navascués, Ph.D., 1971, Rutgers — The State University

Assistant Professor Mario Trubiano, Ph.D., 1979, University of Massachusetts

French

M.A.

Specializations

French studies which include French literature, French-Canadian literature, Black-French studies, linguistics.

Master of Arts

Admission requirements: GRE or MAT, 24 semester hours, or equivalent, of French, of which a minimum of nine must be literature.

Program requirements: thesis, eight 500-level courses and comprehensive examination; or, for non-thesis program, ten 500-level courses including one course with a major paper requiring significant independent research, and comprehensive examination. A maximum of nine credits from 400-level courses may be counted toward the thesis or the non-thesis program.

Spanish

M.A.

Specializations

The master of arts in Spanish is designed for those who wish to perfect their undergraduate achievement in the general area of Hispanic studies, including language mastery and understanding of literature in the total context of civilization and culture. The literary production of Spain, Spanish America, and the Spanish-speaking peoples of the United States will be studied. Any one of these areas could provide a field for specialization.

Master of Arts

Admission requirements: MAT or GRE, undergraduate major in Spanish or equivalent, including 12 credits in Spanish or Hispanic-American literature. Qualified students may be admitted with less than 12 credits but must make them up without graduate credit.

Program requirements: all work carried out in Spanish. For thesis option, SPA 501, the seven core courses (21 credits), and thesis (6 credits). For non-thesis option, SPA 501, the seven core courses, 2 elective courses from a wide variety of disciplines (6 credits), and one course with a major paper requiring significant independent research.

FRN Courses
French

402 French Phonetics *(II, 3)*
411 Medieval Literature *(I, 3)*
422 Sixteenth-Century Literature *(I or II, 3)*
433 Seventeenth-Century Literature *(II, 3)*
443 Eighteenth-Century Literature *(I, 3)*
453 Nineteenth-Century Literature Until 1848 *(I, 3)*
454 Nineteenth-Century Literature Since 1848 *(I, 3)*
461 Twentieth-Century Theatre *(II, 3)*
465 Twentieth-Century Prose *(I, 3)*
473 French-Canadian Literature *(II, 3)*
444 Black Literature in French *(II, 3)*
497, 498 Directed Study *(I and II, 3 each)*

501 Advanced Composition *(II, 3)* Stylistics to prepare undergraduate and graduate majors to write expository French prose. *(Lec. 3) Pre: graduate status or permission of instructor. In alternate years.* Porter

503 History of the French Language *(II, 3)* Linguistic development of French from the *Serments de Strasbourg* to the end of the Middle Ages. Particular attention to sound and form changes. *(Lec. 3) Pre: graduate status or permission of instructor. In alternate years.* Porter

Note: Courses 513 through 594 include lectures, discussions, readings, individual research and a research paper.

513 Seminar in Medieval Literature *(I, 3) Pre: graduate status or permission of instructor.* Staff

523 Seminar in Sixteenth-Century Literature *(I, 3) Pre: graduate status or permission of instructor.* Rothschild

533 Seminar in Seventeenth-Century Literature *(I, 3) Pre: gradute status or permission of instructor.* Morello

544 Seminar in Eighteenth-Century Literature *(II, 3) Pre: graduate status or permission of instructor.* Rothschild

554, 555 Seminar in Nineteenth-Century Literature *(I and II, 3) Pre: graduate status or permission of instructor.* Touloudis and Chartier

564 Seminar in Modern Poetry *(I, 3) Pre: graduate status or permission of instructor.* Waters

565 Seminar in Twentieth-Century Theatre *(II, 3) Pre: graduate status or permission of instructor.* Waters

566 Seminar in Twentieth-Century Prose *(I, 3) Pre: graduate status or permission of instructor.* Waters

594 Special Topics *(I and II, 3)* Group and/or individual investigation of special problems in French literature. Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

901, 902 Reading Course in French for Graduate Students *(I and II, 0) 901:* Fundamentals of grammar and syntax necessary to develop reading knowlege. Assumes no prior knowlege of French. *902:* Exercises in reading scholarly and scientific texts. Hyland

SPA Courses
Spanish

401 Oral and Dramatic Presentation of Hispanic Literature *(I, 3)*
409 History of the Spanish Language *(II, 3)*
410 Field Workshop *(SS, 3-6)*
430 Castilian Prose of the 16th and 17th Centuries *(II, 3)*
431 Drama and Poetry of the 16th and 17th Centuries *(II, 3)*
451 The Spanish Novel of the Nineteenth Century *(I, 3)*
470 Topics in Hispanic Literature *(I and II, 3)*
481 Don Quixote *(I, 3)*
485 Modern Spanish Narrative *(II, 3)*
486 Modern Spanish Poetry and Drama *(II, 3)*
487 Modern Spanish-American Narrative *(I, 3)*
497, 498 Directed Study *(I and II, 3 each)*

501 Pedagogical, Artistic, and Cultural Perspectives *(I, 3)* Introduction to the use of culture and the arts in effective language teaching, as well as to methods of literary interpretation. *(Lec. 3) Pre: graduate status or permission of instructor.* Hutton

502 Language Structure and Expression *(II, 3)* Advanced study of grammar, syntax, and lexical usage. Practice in speaking and composition. Recommended for present and prospective teachers and those working with Spanish-speaking people. *(Lec. 3) Pre: graduate status or permission of instructor. In alternate years, next offered spring 1984.* Navascués

510 Contemporary Spanish Workshop *(SS, 3-6)* New developments in all areas of Hispanic studies including pedagogical matters and classroom techniques. *(Lec. 3-6) Pre: graduate status or permission of instructor.* Hutton and Staff

571 Modern Spanish-American Authors *(I, 3)* Analysis of human and artistic values in the drama, poetry, and narrative of selected modern Spanish-American authors. *(Lec. 3) Pre: graduate status or permission of instructor. In alternate years, next offered fall, 1983.* Navascués

572 Evolution of Spanish-American Culture and Thought *(II, 3)* Development of Spanish-American thought and cultural trends, as portrayed in major works of artists and thinkers. *(Lec. 3) Pre: graduate status or permission of instructor. In alternate years, next offered spring, 1984.* Morin

581 Spanish Writers *(I, 3)* An examination of literature as artistic and cultural expression through intensive study of a selection of major works. *Pre: graduate status or permission of instructor. (Lec. 3) In alternate years, next offered, fall, 1982.* Manteiga

582 Cervantes: Theatre and Novels *(II, 3)* Reading and critical interpretation of selections from *Comedias* and *Entremeses, Las novelas ejemplares, La Galatea, Persiles y Sigismunda. (Lec. 3) Pre: graduate status or permission of instructor. In alternate years, next offered spring, 1983.* Hutton

584 Interpretations of Modern Spain *(I, 3)* Development of Spanish thought particularly with respect to sociological and cultural problems from the eighteenth century to the contemporary period as seen through the writings of significant essayists. *(Lec. 3) Pre: graduate status or permission of instructor. In alternate years, next offered spring, 1984.* Hutton

590 The Hispanic Presence in the United States *(II, 3)* A study of the establishment of the Hispanic presence and its heritage in the art, folklore, and language of the United States, and an analysis of the literature of the Spanish-speaking peoples. *(Lec. 3) Pre: graduate status or permission of instructor. In alternate years, next offered fall, 1982.* Hutton

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

GER Courses
German

409 History of the German Language *(I, 3)*
421 Business German *(I, 3)*
431 German Literature from 800 to 1700 *(II, 3)*
441, 442 German Literature of the Eighteenth Century *(I and II, 3 each)*
451, 452 German Literature of the Nineteenth Century *(I and II, 3 each)*
485, 486 Special Studies *(I and II, 3 each)*
497 Directed Study *(I and II, 1-3)*
498 Directed Study *(I and II, 3)*

901, 902 Reading Course in German for Graduate Students *(I and II, 0) 901:* Fundamentals of grammar and syntax necessary to develop reading knowledge of German. *902:* Exercises in reading scholarly and scientific texts. Staff

987, 988 German Play Production *(SS, 1)* Study and production of a German play or plays. *Pre: 215, 216 or equivalent. Students may register concurrently in 485, 486.* Staff

GRK Courses
Greek

497, 498 Directed Study *(I and II, 3)*

ITL Courses
Italian

408 The Italian Language *(I or II, 3)*
455 Selected Italian Authors *(I or II, 3)*
465 Topics in Italian Literature *(I or II, 3)*
481, 482 The Works of Dante Alighieri *(I and II, 3)*
497, 498 Directed Study *(I and II, 3 each)*

LAT Courses
Latin

497, 498 Directed Study *(I and II, 3 each)*

LIN Courses
Linguistics

402 Syntactic Analysis *(I and II, 3)*
431 Applied Linguistics in the Language Laboratory *(I, 1)*
497, 498 Directed Study *(I and II, 3 each)*

The following are related, specialized courses in historical linguistics offered in the Departments of English and Languages.

ENG 530 History of the English Language
FRN 503 History of the French Language
GER 409 History of the German Language
ITL 409, 410 History of the Italian Language
SPA 409 History of the Spanish Language

RUS Courses
Russian

460, 461 The Russian Novel *(I and II, 3 each)*
497, 498 Directed Study *(I and II, 3 each)*

901, 902 Reading Course in Russian for Graduate Students *(I and II, 0 each) 901:* Fundamentals of grammar and syntax necessary to develop reading knowledge. Assumes no prior knowledge of Russian. *902:* Exercises in translating scholarly and scientific texts. Staff

Library Science

M.L.S., D.A.L.

Graduate Faculty

Dean, Graduate Library School: Professor Bernard S. Schlessinger, Ph.D., 1955, University of Wisconsin; M.L.S., 1975, University of Rhode Island
Professor Daniel P. Bergen, Ph.D., 1970, University of Minnesota
Associate Professor Lucy V. Salvatore, M.S.L.S., 1958, University of Illinois
Associate Professor Stewart P. Schneider, Certificate in Advanced Librarianship, 1974, School of Library Service, Columbia University
Associate Professor Jonathan S. Tryon, Certificate in Advanced Librarianship, 1974, Columbia University; J.D., 1981, Suffolk University
Associate Professor Lemuel B. Woods, Ph.D., 1977, University of Texas
Assistant Professor Lea M. Bohnert, M.A., 1947, University of Chicago
Assistant Professor Patricia Jensen, M.Ed., 1961, University of New Hampshire; M.S.L.S., Southern Connecticut State College
Assistant Professor Thomas T. Surprenant, Ph.D., 1979, University of Wisconsin, Madison

Specializations

The overall goal of the school is to educate librarians who will not only function effectively, but also demonstrate the capacity to affect the course of librarianship.

Through consultation with advisers, students prepare for careers in academic, school, public, or special libraries. They may also plan for specialization in areas such as children's service, reference and bibliography, cataloging, special collections, media programs, information science, computer service, administration, young adult services, and library history.

Master of Library Science

Admission requirements: MAT or GRE and the bachelor's degree. All materials required for application should be received by the Graduate School by November 15 for spring semester admission, February 15 for summer admission, and April 15 for fall admission. Notification of acceptance or rejection is mailed approximately six weeks after receipt by the Graduate School.

Program requirements: 36 credit hours consisting of: LSC 501, 502, 503, 504, and 505; one course selected from LSC 520, 521, 522, or 523; 18 hours of electives of which up to 9 may be taken in courses outside library science when relevant to the student's specializtion; one course with major paper requiring significant independent research; written comprehensive examination. Up to 21 hours may be taken at the Regional Centers at University of Connecticut, University of Massachusetts, and the University of New Hampshire.

Diploma in Advanced Librarianship

Admission requirements: MAT or GRE and the master's degree in library science, or a related field if prerequisites are made up; two years of post-master's substantive library experience; and evidence of high quality graduate and professional work. Application deadlines are same as for M.L.S.

Program requirements: a minimum of 30 credits in an individualized, coherent, interdisciplinary program developed in consultation with a faculty adviser to accommodate students in a wide variety of specializations including academic libraries, public libraries, school library media centers, special libraries; service to children and young adults; information systems, data processing and automation; and media. All programs will include a special problems seminar, a course in management or administration preferably taken outside the Graduate Library School, a research course, and the preparation of a research paper with a practical or operational orientation.

Cooperative Program (M.A. in History and M.L.S.)

By proper selection of coursework, a student may earn simultaneously the degrees Master of Arts in history and Master of Library Science.

Admission requirements: GRE (advanced test desirable) and other requirements listed for history and library science. Applicant must apply and be accepted in both programs. Applications (in quadruplicate) should indicate History/Library Science as the field of specialization.

Program requirements: student must submit individual 30-credit (minimum) programs of study for each degree that satisfy specific core requirements for these programs. Since a maximum of six credits of coursework may be jointly used to satisfy degree requirements, a minimum of 54 credits total is required to satisfy the requirements for both degrees.

Cooperative Program (M.P.A. and M.L.S.)

A second cooperative program permits joint enrollment in the M.L.S. and Master of Public Administration programs, each of which requires a minimum of 36 credits when taken separately. The integrated pursuit of the two degrees makes it possible for 9 credits of appropriately selected coursework from one program to serve as electives in the other, and for 6 credits of such coursework to be applied in the opposite direction. Thus, when planned and taken jointly, the two programs can be completed with a total of 57 credits.

Admission requirements: GRE and other requirements listed for M.L.S. and M.P.A. Applicant must apply and be accepted in both programs. Applications (in quadruplicate) must indicate M.L.S./M.P.A. as the field of specialization.

Program requirements: Each student must complete the required core courses for both programs plus 3 credits of PSC 590 for the M.P.A. and 3 credits chosen from LSC 520, 521, 522, or 523 for the M.L.S. Students must file separate programs of study for each degree, indicating the courses to be jointly counted. Each student must pass the separate comprehensive examination for each degree. A student who fails to complete one of the programs may, of course, complete the other in accordance with the separate program of study.

LSC Courses
Library Science

501 Foundations of Library Science *(I and II, 4)* Overview of the field covering the language and literature of librarianship; the history and functions of libraries; the nature of various types of libraries, profession, operations, and the new technologies. *(Lec. 4) Pre: bachelor's degree or permission of instructor.* Bergen, Schlessinger, and Surprenant

502 Library Administration *(I and II, 3)* Libraries and their governing agencies, scientific management principles, organization and operation of library departments, personnel problems and procedures, budget preparation, statistics, quarters, and planning. *(Lec. 3)* Woods and Staff

503 Collection Department *(I and II, 3)* Study of and practice in using the principles involved in the selection of books and nonbook materials for collections of all types of libraries. *(Lec. 3)* Tryon

504 Reference and Information Services *(I and II, 3)* Practical experience in the use of

basic reference materials, with readings and discussion of the philosophy and administrative aspects of reference work. *(Lec. 3)* Schneider

505 Organization of Library Materials *(I and II, 3)* Introduction to the principles and practice of descriptive and subject cataloging and classification using the Dewey decimal classification and Sears subject headings, with an introduction to the Library of Congress classification. Emphasis is on books and booklike materials. *(Lec. 3)* Jensen

506 Technical Services *(I, 3)* Principles and policies employed in the acquisition, organization, conservation, and circulation of books and nonbook materials in libraries of various kinds. *(Lec. 3)* Jensen

510 History of Books and Printing *(I, 3)* Western civilization as affected by the book arts and the extension of culture through the printed book, with stress on literary property and censorship as related to printing and libraries. *(Lec. 3)* Tryon

511 Comparative Librarianship *(I, 3)* The practice of librarianship in selected countries, including the social, economic, and political factors influencing its development, with consideration of the role of cooperation among international organizations. *(Lec. 3)* Bergen

512 History of Libraries and Librarianship *(I, 3)* The development of libraries and librarianship within a cultural, social, and economic context from antiquity to the present. Western civilization will be emphasized. *(Lec. 3)* Bergen

513 Intellectual Freedom and Censorship *(II, 3)* Historical development and current status of the concept of intellectual freedom and the restraints that past and present societies have imposed on it. Special attention given to the librarian's role in defense of intellectual freedom. *(Lec. 3)* Tryon

514 The Library in Society *(II, 3)* Character and function of the library as a social agency, with special attention to the philosophies of contemporary librarianship. *(Lec. 3)* Bergen

515 The Library and the Communication Process *(II, 3)* The importance of applying communication theories to the study of librarianship. Basic concepts and models of the communication and information transfer process. *(Lec. 3)* Surprenant

520 The School Library/Media Center *(I, 3)* The school library in relation to the school curriculum, other community library resources, and extracurricular needs of the students. Special problems in the selection of materials, budgets, and standards for the library as a materials center with an active part in the teaching function of the school. *(Lec. 3) Pre: 502.* Salvatore

521 Public Library Service *(I, 3)* Reading on and discussion of the backgrounds, aims, and problems of the American public library, with particular attention to larger unit systems. *(Lec. 3) Pre: 502.* Woods

522 College and University Library Service *(II, 3)* Philosophic and practical considerations implicit in the functions, organization, and management of college and university librariet as these differ from other types of libraries. *(Lec. 3) Pre: 502.* Tryon

523 Special Library Service *(II, 3)* Organization, management, and regular and special procedures as they apply to special libraries, with particular emphasis upon standards and planning for space and equipment. *(Lec. 3) Pre: 502.* Bohnert

527 Seminar in Library Administration *(II, 3)* Intensive study of selected problems in important areas of library administration by means of discussion, readings, special lectures, and the presentation of papers based on literature surveys or research. *(Lec. 3) Pre: permission of instructor.* Woods

528 Media in the Library *(I, 3)* The role of AV materials in libraries and media centers. *(Lec. 3) Pre: graduate standing or permission of instructor.* Surprenant

529 Theory and Production of Library Media Communications *(I and II, 3)* A team taught course intended to acquaint students with the basic audiovisual production skills necessary for the application by the library of theoretical communications concepts. *(Lec. 2, Lab. 3) Pre: 528 or permission of instructor.* Surprenant and Staff

530 Reading Interests of Children *(I, 3)* Survey of children's literature, analyzing current trends, the limited-vocabulary book at various levels, and the significance of illustrations for the reading process. Main emphasis on informational books as recreational reading. *(Lec. 3) Pre: 503.* Salvatore

531 Reading Interests of Adolescents *(II, 3)* Materials of special interest to high school students in school and public libraries, stressing nonfiction but including fiction for the age group and for adults and the responsibility of the library in the drop-out problem. *(Lec. 3) Pre: 503.* Salvatore

533 Children's Library Materials *(I, 3)* Books and related library materials in the area of creative literature for children: history, bibliography, selection, evaluation, and presentation. *(Lec. 3) Pre: 503.* Salvatore

536 Storytelling *(I or II, 3)* Selection, adaptation, and presentation of stories for children of all ages, including attention to sources of materials, planning the story hour, and training and practice in the art of storytelling. *(Lec. 3)* Salvatore

537 Health Sciences Librarianship *(II, 3)* Introduction to the operation and characteristics of health science libraries and an overview of the area of health science bibliography. *(Lec. 3) Pre: 502 or permission of instructor.* Schlessinger

538 Law Librarianship *(I, 3)* An introduction to legal bibliography and research and to a broad range of problems involved in the administration and operation of various kinds of law libraries. *(Lec. 3) pre: 502 and 504.* Wise

540 Library Materials in the Humanities *(I or II, 3)* Important library resources in the humanities, including the major works, serial publications, and reference and bibliographical materials thereof. *(Lec. 3) Pre: 504.* Schneider

541 Library Materials in the Social Sciences *(II, 3)* Important library resources in the social sciences, including the major works, serial publications, and reference and bibliographical materials thereof. *(Lec. 3) Pre: 504.* Bergen or Schneider

542 Library Materials in Science and Technology *(I or II, 3)* Important resources in science and technology including the major works, serial publications, and reference and bibliographical materials thereof. *(Lec. 3) Pre: 504.* Bohnert

543 Government Publications *(I or II, 3)* Survey of the publishing activities and publications of national, state, and local governments with emphasis on the publications of the United States government. *(Lec. 3) Pre: 504.* Schneider

544 Information Science for Librarians *(II, 3)* Introduction to information storage and retrieval (analysis, semantics, thesaurus building, and data banks and their implications) as it applies to librarianship. *(Lec. 3)* Bohnert

545 Technical Information Centers *(II, 3)* Study of centers which provide publication, consultant, and question-answering services, emphasizing the differences between them and technical libraries and professional societies. *(Lec. 3) Pre: permission of instructor.* Bohnert

546 Computer Systems in Library Automation *(I, 3)* Introduction to principles of systems analysis in libraries; hardware and software systems in library applications; basics of one computer language with practice in format design and programming for input and retrieval. *(Lec. 3) Pre: permission of instructor.* Schlessinger

550 Advanced Cataloging *(II, 3)* Theory and problems in descriptive and subject cataloging. Comparative analysis of different classification schemes with emphasis on the use of Library of Congress classification and subject headings. Includes organization of nonbook materials. *(Lec. 3) Pre: 505.* Staff

551 Organization of Nonprint Materials *(I or II, 3)* A practical and theoretical study of the development of procedures for intellectual and physical access to materials not in conventional print form, such as audio, graphic, audiovisual, and video material, as well as microforms, maps, and vertical file materials. *(Lec. 3) Pre: to be taken concurrently with or following 505.* Surprenant

560 Research in Librarianship *(II, 3)* Methods of investigating problems in library science and an introduction to and evaluation of the literature of the field. *(Lec. 3) Pre: permission of instructor.* Woods

562 Administration of Special Collections, Archives, and Manuscripts *(I or II, 3)* Principles and techniques for administering manuscript and archival repositories, including acquisitions policies, appraisal criteria, methodology, and preservation practices. *(Lec. 3) Pre: core courses in library science or permission of instructor.* Maslyn

564 Introduction to Library Conservation *(I or II, 3)* Fundamentals of library conservation essential for effective management of programs of preventive and restorative conservation for books, documents, prints, maps, broadsides, works of art on paper, and other library materials. *(Lec. 3)* Staff

566 Bibliographic Instruction in Libraries *(I, 3)* Survey of current practices and trends. Advantages and limitations of specific types of instruction in library use. Particular attention to planning, producing, operating, and evaluating library instruction programs. *(Lec. 3) Pre: 504 and 505.* Suprenant

591, 592, 593 Independent Work *(By Appt., 1-3 respectively)* Supervised reading or investigation in areas of special interest to students who obtain written approval for such study prior to registration for the semester for which it is proposed. *Pre: 18 hours of library science with a B average.* Staff

595 Professional Field Experience *(I and II, 1-3)* Directed field experience applying theory to practice in libraries, information centers, and related organizations under the joint supervision of a member of the faculty and the professional staff of the cooperating institutions. *(45 hrs. per credit) May be repeated once. Pre: completion of at least 18 hours of library science with a B average.* Staff

Marine Affairs

M.A., M.M.A.

Graduate Faculty

Chairperson: Associate Professor Lawrence Juda, Ph.D., 1973, Columbia University
Professor Lewis M. Alexander, Ph.D., 1949, Clark University
Professor John A. Knauss, Ph.D., 1959, University of California
Professor Nelson Marshall, Ph.D., 1941, University of Florida
Professor Niels Rorholm, Ph.D., 1954, University of Minnesota
Associate Professor Niels West, Ph.D., 1973, Rutgers—The State University
Assistant Professor Gerald H. Krausse, Ph.D., 1975, University of Pittsburgh
Assistant Professor Dennis W. Nixon, J.D., 1975, University of Cincinnati; M.M.A., 1976, University of Rhode Island
Instructor Bruce E. Marti, M.A., 1975, Florida Atlantic University
Adjunct Professor Claiborne D. Pell, M.A., 1946, Columbia University

Specializations

Coastal zone management, marine transportation and port planning, fisheries law and management, international marine policy and law.

Master of Arts (M.A.)

Admission requirements: GRE and bachelor's degree in related science or social science. For international students, minimum TOEFL score of 575. Full-time applicants are admitted for September only.

Program requirements: thesis and GMA 482, 502, 571, 577, 651, 652, OCG 401 or appropriate oceanography substitute, REN 514 or appropriate resource economics substitute, plus a minimum of 15 elective credits for a total of 45 credits.

Master of Marine Affairs (M.M.A.)

Admission requirements: GRE, prior graduate degree or five years of equivalent experience in marine areas. For international students, minimum TOEFL score of 575. Applicants are admitted for September only.

Program requirements: non-thesis program; GMA 571, 577, 651, 652, REN 514, OCG 401 or appropriate oceanography substitute, plus 12 elective credits for a total of 30 credits; written comprehensive examination.

Graduate Certificate Program in Commercial Fisheries

As an adjunct to the Master of Marine Affairs program, an additional 15-credit program, leading to a graduate certificate awarded by the Dean of the Graduate School is offered in commercial fisheries. The joint 45-credit program is designed to combine the evaluative use, and control aspects of the M.M.A. curriculum with the technology and performance of the marine commercial fisheries.

Admission requirements: GRE, appropriate background or undergraduate preparation, and concurrent enrollment in the M.M.A. program.

Program requirements: FMT 518, 591, 592, plus 15 credits selected from the following electives, of which 9 credits are applied towards the M.M.A. program and 6 towards the graduate certificate: APG 411, FMT 416, 452, 521, OCG 568, REN 543.

Financial aid: assistantships, fellowships and scholarships are not available to participants in the graduate certificate program as such, but may be held by students concurrently enrolled in the M.M.A. program.

GMA Courses
Geography and Marine Affairs

410 Problems in Geography and Marine Affairs *(II, 3)*

411 Urban Geography *(I, 3)*
413 (or APG 413) Peoples of the Sea *(I, 3)*
421 Introductory Cartography *(I, 3)*
422 Advanced Cartography *(II, 3)*
432 Seminar in Political Geography *(II, 3)*
446 Geography of the Polar Regions *(II, 3)*
461 Coastal Zone Uses *(I, 3)*
471 Island Systems *(II, 3)*
472 Marine Recreation *(II, 3)*
482 Quantitative Methods in Geography and Marine Affairs *(II, 3)*
491, 492 Special Problems in Geography *(I and II, 3 each)*
499 Directed Study *(I and II, 1-3)*

502 Research Methods in Geography and Marine Affairs *(I, 3)* Emphasis on the application of alternative research methods utilized in a typical interdisciplinary study. Development of specific research projects. *Pre: 482 or permission of department. (Lec. 3)* Staff

512 Seminar in Marine Science Policy and Public Law
See Political Science 512.

516 (or CPL 516) Seminar on the Urban Waterfront *(I, 3)* The urban environment, its evolution, structure, and function as it relates to the waterfront. Topics on policy, management, and utilization on the local and regional level will be covered. Field trip and student project required. *Pre: previous or current enrollment in GMA or CPL courses or permission of instructor.* Krausse and West

521 Coastal Zone Law *(II, 3)* Examination of the authority of different levels and agencies of government to make decisions affecting coastal regions. Survey of existing and proposed state and national legislation affecting coastal regions. *(Lec. 3)* Cameron

523 Fisheries Law and Management *(II, 3)* Examination of the relationship between law and fisheries policy on the international and national level, law relating to fisheries, jurisdictional levels, function of law in implementing fisheries management policy. *(Lec. 3) Pre: permission of instructor.* Cameron

562 Admiralty Law *(I, 3)* Fundamentals of admiralty law: collisions at sea, bills of lading, marine insurance, and rights of seamen. Case studies of marine transportation problems and their resolution by law. *(Lec. 3) Pre: previous or concurrent enrollment in FMT 416 or waiver by both departments.* Nixon

563 Marine Transportation Geography *(II, 3)* Passenger and commodity transportation. Analysis of the relationship between transportation services and the spatial distribution of activities. Emphasis on multimodel transport and bulk commodities. *(Lec. 3) Pre: one introductory GMA course or permission of instructor. In alternate years.* Staff

564 Port Geography and Policy *(II, 3)* Analysis of coastal and international trade routes and the response of ports. Special emphasis on the container revolution, liquid natural gas transportation, and deep water ports for supertankers. *(Lec. 3) In alternate years. Pre: FMT 416 or waiver by both departments.* Marti

571 Marine Geography *(I, 3)* The marine region as a unique complex of physical and cultural elements. The purpose is to analyze functional relationships within the region and to assess forms of regional organization and control. *(Lec. 3) Pre: permission of department.* Alexander

572 Geography of Ocean Regions *(II, 3)* A global study of the nature and use of ocean basins, semi-enclosed seas, and other marine areas, with special emphasis on regional arrangements and regimes. *(Lec. 3) Pre: 571 or permission of department. In alternate years.* Alexander

577 (or PSC 577) International Ocean Law *(I, 3)* Principles of international law as they relate to ocean management problems. Jurisdiction in the territorial sea, contiguous zones, and the deep seabed will be examined within the international legal framework. *(Lec. 3) Pre: 312, CPL 434, or permission of instructor.* Juda

578 International Ocean Organizations *(II, 3)* International organizations involved in marine-related activities, including their planning, management, and regulatory and assistance functions. Attention to the impact of these organizations on national policies in the developed and developing worlds. *(Lec. 3) Pre: 483.* Juda

586 Environmental Impact Assessment and Analysis *(II, 3)* A survey of environmental legislation and proposed guidelines, together with a review of physical and socio-economic methods of environmental analysis and assessments. Preparation of environmental impact statements. *(Lec. 3) Pre: BOT (or ZOO) 262 or permission of instructor.* West

591, 592 Directed Study or Research *(I and II, 3)* Areas of special research interests of graduate students. *(Lec. 3) Pre: permission of department.* Staff

595 Problems of Modernization in Developing Nations
See Resource Economics 595.

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. Staff

602 Federal Ocean Policy and Organization *(II, 3)* Ocean policy development and implementation by the executive and legislative branches of government. Allocation of powers and analysis of the decision-making process for the oceans. *(Lec. 3) Pre: permission of department.* Juda

651, 652 Marine Affairs Seminar *(I and II, 3 each)* Interdisciplinary seminar conducted by Marine Affairs Program faculty supplemented by guest speakers from industry and government. Focuses on problems of marine resources development and management at the local/state, national, and international policy levels. *(Lec. 3) Pre: permission of director.* Alexander, Cameron, Juda, Marti, Nixon and West

FMT Courses
Fisheries and Marine Technology

416 Marine Transportation *(II, 3)*
452 (or ASP 452) Industrial Fishery Technology *(II, 3)*

515 Fishery Science *(I, 3)* Principles of fishery science including population measurements, life histories, estimations of stocks, management strategies, survey of world fisheries, and resource management as related to commercial fisheries. *(Lec. 3) Pre: BOT 111 or ZOO 111. Calculus preferred.* Recksiek and Skud

518 Marine Fisheries Technology *(I, 3)* The commercial resource, its exploitation and use. Capture techniques and equipment. Aspects of commercial activities, fishing vessel operations and technology. *(Lec. 3) Pre: permission of instructor.* Recksiek

521 Fishing Gear Technology *(II, 3)* Evaluation of fishing gear behavior and performance using theoretical, model scaling and statistical analysis techniques. Field and laboratory measurement procedures. *(Lec. 3) To be taken concurrently or following 518. Pre: permission of instructor.* Staff

591, 592 Special Problems *(I and II, 1-3 each)* Advanced work, under the supervision of a staff member, arranged to suit individual needs of students in various fields of fisheries and marine technology. *(Lec. and/or Lab. according to nature of problem) Pre: permission of department.* Staff

Mathematics

M.S., Ph.D.

Graduate Faculty

Chairperson: Professor E. Ramnath Suryanarayan, Ph.D., 1961, University of Michigan
Professor Raymond A. Beauregard, Ph.D., 1968, University of New Hampshire
Professor Dilip K. Datta, Ph.D., 1963, Delhi University
Professor Rodney D. Driver, Ph.D., 1960, University of Minnesota
Professor John B. Fraleigh, M.A., 1956, Princeton University
Professor Gerasimos Ladas, Ph.D., 1968, New York University
Professor James T. Lewis, Ph.D., 1969, Brown University
Professor Pan-Tai Liu, Ph.D., 1968, State University of New York, Stony Brook

Professor Lewis I. Pakula, Ph.D., 1972, Massachusetts Institute of Technology
Professor John S. Papadakis, Ph.D., 1971, Polytechnic Institute of Brooklyn
Professor Emilio O. Roxin, Ph.D., 1959, University of Buenos Aires
Professor Oved Shisha, Ph.D., 1958, Hebrew University
Professor Robert C. Sine, Ph.D., 1962, University of Illinois
Professor Ghasi Ram Verma, Ph.D., 1957, Rajasthan University
Associate Professor Norman J. Finizio, Ph.D., 1972, Courant Institute of Mathematical Sciences, New York University
Associate Professor Edward A. Grove, Ph.D., 1969, Brown University
Associate Professor John T. Montgomery, Ph.D., 1971, University of Wisconsin
Associate Professor Sol Schwartzman, Ph.D., 1953, Yale University
Assistant Professor Robert A. Barron, M.A., 1955, Fordham University
Assistant Professor Roderick P. Caldwell, Ph.D., 1962, University of Illinois
Assistant Professor Maria E. Schonbek, Ph.D., 1976, University of Michigan
Adjunct Professor Derrill Bordelon, Ph.D., 1963, University of Maryland
Adjunct Professor Charles F. Osgood, Ph.D., 1964, University of California, Berkeley
Adjunct Assistant Professor Frederick R. DiNapoli, Ph.D., 1969, University of Rhode Island
Adjunct Assistant Professor David Wood, Ph.D., 1972, University of Rhode Island

Specializations

Ordinary, functional, and stochastic differential equations, partial differential equations, abstract differential equations, functional analysis, approximation theory, probability, fluid mechanics, control theory and differential games.

Master of Science

Admission requirements: GRE with advanced test in mathematics, bachelor's degree with strong undergraduate background in mathematics. Applicants with deficiencies in mathematics may be accepted subject to taking certain undergraduate courses in addition to the graduate program requirements. Applicants without a bachelor's degree who have completed at least 60 credits of undergraduate work and have an outstanding record in mathematics as evidenced by transcripts, letters of recommendation and outstanding performance on the Graduate Record Examination also may be accepted.

Program requirements: 30 credit hours (or 24 plus thesis), including at least 18 credits in mathematics of which at least 12 must be at the 500 level or higher. A course requiring a substantial paper involving significant independent study and a written comprehensive examination are required for non-thesis option. MTH 435 and 513 must be completed with a grade of A or B. Recommended courses include MTH 515, 525, 535, 536, and 562.

Doctor of Philosophy

Admission requirements: same as for master's program.

Program requirements: MTH 513, 515, 525, 535, 536, and 562, plus specialized courses and electives. Reading ability (in candidate's specialty and with a dictionary) in one language chosen from French, German, or Russian. An oral qualifying examination is required of all candidates.

Please also see the listing under Applied Mathematical Sciences on page 23.

General Information

Programs of study can be designed for people who are employed on a full-time basis.

MTH Courses
Mathematics

418 Matrix Analysis *(II, 3)*
420 Topics in Foundations *(I, 3)*
425 Topology *(I, 3)*
435, 436 Introduction to Mathematical Analysis I and II *(I and II, 3 each)*
437, 438 Advanced Calculus and Applications *(I and II, 3 each)*
441 Introduction to Partial Differential Equations *(I, 3)*
444 Ordinary Differential Equations *(II, 3)*
451 Introduction to Probability and Statistics *(I, 3)*
452 Mathematical Statistics *(II, 3)*
456 Probability *(II, 3)*
461 Methods of Applied Mathematics *(I, 3)*
462 Functions of a Complex Variable *(II, 3)*
471 Introduction to Numerical Analysis I *(I and II, 3)*
472 Introduction to Numerical Analysis II *(I, 3)*
492 Special Problems *(I and II, 1-3)*

513 Linear Algebra *(I or II, 3)* Linear spaces and transformations, linear functionals, adjoints, projections, diagonalization, Jordan form of matrices, inner products; positive, normal, self-adjoint, and unitary operators; spectral theorem, bilinear and quadratic forms. *(Lec. 3)* Staff

515, 516 Algebra I, II *(I and II, 3 each)* Groups, rings, modules, commutative algebra. *(Lec. 3) Pre: 316.* Beauregard

525 Topology *(I, 3)* Topological spaces, separation properties, connectedness, compactness, uniformities. Function spaces, spaces of continuous functions, and complete spaces. *(Lec. 3) Pre: 425 or equivalent.* Staff

535, 536 Measure Theory and Integration *(I and II, 3 each)* Elements of topology and linear analysis. Lebesgue measure and integration in R, in Rn and in abstract spaces. Convergence theorems. Bounded variation, absolute continuity, and differentiation. Lebesgue-Stieltjes integral. Fubini and Tonelli theorems. The classical Banach spaces. *(Lec. 3) Pre: 436.* Staff

545, 546 Ordinary Differential Equations I, II *(I and II, 3 each)* Existence and uniqueness theorems. Continuous dependence on parameters and initial conditions. Singularities of the first and second kinds, self-adjoint eigenvalue problems on a finite interval. Oscillation and comparison theorems. Elements of asymptotic theory. Elements of stability theory of Lyapunov's second method. *(Lec. 3) Pre: 435 and 462.* Staff

550 Probability and Stochastic Processes *(I, 3)* Review of probability theory. Generating functions, renewal theory, Markov chains and processes, Brownian motions, stationary processes. *(Lec. 3) Pre: 451, 435, or 437 or permission of instructor.* Staff

551 Mathematical Statistics *(I, 3)* Theory of estimation and hypothesis testing. Large sample methods. Regression and analysis of variance. *(Lec. 3) Pre: 451, 435 or 437 or permission of instructor.* Staff

561 Advanced Applied Mathematics *(II, 3)* Linear spaces, theory of operators. Green's functions, eigenvalue problems of ordinary differential equations. Application to partial differential equations. *(Lec. 3) Pre: 461.* Verma

562 Complex Function Theory *(I, 3)* Analytic continuation, Riemann surfaces. The theory of conformal mapping. Representation theorems and applications. Entire functions. *(Lec. 3) Pre: 462.* Staff

572 Numerical Analysis *(II, 3)* Further numerical methods of solution of simultaneous equations, partial differential equations, integral equations. Error analysis. *(Lec. 3) Pre: 472.* Staff

591, 592 Special Problems *(I and II, 1-3 each)* Advanced work, under the supervision of a member of the department and arranged to suit the individual requirements of the student. *Pre: permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

629, 630 Functional Analysis I, II *(I and II, 3 each)* Banach and Hilbert spaces, basic theory. Bounded linear operators, spectral theory. Applications to analysis. Application to a special topic such as differential operators, semigroups and abstract differential equations, theory of distributions, or ergodic theory. *(Lec. 3) Pre: 536 or permission of instructor.* Staff

641 Partial Differential Equations I *(I, 3)* First order systems. The Cauchy-Kowalewsky

theorem. The Cauchy problem. Classification of partial differential equations. Hyperbolic equations. Mainly the theory of the subject. Students interested in techniques for the solution of standard equations should take 441. *(Lec. 3) Pre: 215, 435, and 462.* Staff

642 Partial Differential Equations II *(II, 3)* Elements of potential theory. Elliptic equations. Green's function. Parabolic equations. Introduction to the theory of distributions. *(Lec. 3) Pre: 641.* Staff

645 Selected Topics in Differential Equations I *(I, 3)* Advanced topics of current research in differential equations will be presented with a view to expose the students to the frontiers of the subject. *(Lec. 3) Pre: permission of department.* Staff

691, 692 Special Topics I, II *(I and II, 3 each)* Advanced topics of current research in mathematics will be presented with a view to expose the students to the frontiers of the subject. *(Lec. 3) Pre: permission of department.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Mechanical Engineering and Applied Mechanics

M.S., Ph.D.

Graduate Faculty

Chairperson: Professor Thomas J. Kim, Ph.D., 1967, University of Illinois
Professor George A. Brown, Sc.D., 1960, Massachusetts Institute of Technology
Professor Frank DeLuise, M.S., 1950, University of Rhode Island
Professor Rodger B. Dowdell, Ph.D., 1966 Colorado State University
Professor William R. Ferrante, Ph.D., 1962, Virginia Polytechnic Institute
Professor Warren M. Hagist, M.E., 1961, Harvard University
Professor Charles D. Nash, Jr., Ph.D., 1959, Ohio State University
Professor Frederick L. Test, Ph.D., 1956, Pennsylvania State University
Professor Frank M. White, Ph.D., 1959, Georgia Institute of Technology
Professor Mason P. Wilson, Jr., Ph.D., 1968, University of Connecticut
Associate Professor Philip Datseris, Ph.D., 1977, Columbia University
Associate Professor Morris R. Driels, Ph.D., 1973, City University of London
Associate Professor Hamouda Ghonem, Ph.D., 1978, McGill University
Associate Professor Robert H. Goff, M.S., 1956, Cornell University
Associate Professor Richard C. Lessmann, Ph.D., 1969, Brown University
Associate Professor William J. Palm, Ph.D., 1971, Northwestern University
Associate Professor Martin H. Saad, Ph.D., 1971, Illinois Institute of Technology
Assistant Professor Kenneth R. Halliday, Ph.D., 1977, University of Massachusetts
Assistant Professor Jack B. Henderson, Ph.D., 1980, Oklahoma State University
Assistant Professor Arun Shukla, Ph.D., 1981, University of Maryland
Adjunct Professor Hilbert Van H. Schenck, M.S., 1952, Stanford University
Adjunct Associate Professor Richard H. Messier, Ph.D., 1975, Brown University
Adjunct Associate Professor Alexander J. Patton, Ph.D., 1972, University of Rhode Island

Specializations

Fluid mechanics: boundary layer theory, flow noise, turbulence, flow measurement, fluidics, magneto-fluid mechanics, wind-generated power, coastal zone modeling, advanced computer applications; wind-wave interactions.

Machine design: robotics, kinematics, design optimization, fatigue failure, lubrication theory, dynamic face seals, reliability analysis and prediction, computer-aided design.

Solid mechanics: elasticity, plasticity, viscoelasticity, fracture mechanics, photomechanics, wave propagation, elastic stability, plates and shells, finite element methods, nonlinear mechanics.

Systems and control: mathematical modeling of control systems, stability, nonlinear systems, lag systems, advanced computer applications, optimization processes, energy conservation systems analysis, fisheries production models, home heating optimization, advanced dynamics, lumped and distributed parameter vibration theory.

Thermal science: anisotropic heat conduction, convection heat transfer, thermal characteristics of ablative materials, direct energy conversion, solar energy developments, new engine developments, viscoelastic fiber processes, thermal pollution, solar collector systems, computational heat transfer.

Interdisciplinary studies: biomechanics, generalized fatigue failure of biological structure, global pollution problems, sociotechnological problems, computer simulation, oil spill prevention and dispersion, offset costs of pollution, human body vibration.

Master of Science

Admission requirements: GRE, B.S. degree in mechanical engineering, applied mechanics, or aerospace engineering, or in a related field such as engineering science, civil engineering, applied mathematics, applied physics. Students admitted to the program will be expected to have the equivalent of MCE 372 and 373. Students not having this background may be required to make up this deficiency with no program credits.

Program requirements: Thesis option: 30 credit hours exclusive of seminar, a thesis is required of all full-time students, one course outside area of specialization; MCE 501, 502, graduate seminar required of all on-campus students. Non-thesis option for part-time students with permission of department: 33 credit hours exclusive of seminar, including one course outside of specialization, one course requiring a substantial paper involving significant independent study, and comprehensive examination.

Financial aid: a number of graduate and research assistantships are available for qualified M.S. students.

Doctor of Philosophy

Admission requirements: master's degree and GRE.

Program requirements: Dissertation, one course outside area of specialization; research tools in two areas; completion of a minimum of 30 course credits beyond master's exclusive of seminar and research tools; MCE 501, 502, graduate seminar, required of all on-campus students.

Financial aid: a number of graduate and research assistantships are available for qualified Ph.D. students. Temporary instructorships may be available for highly qualified Ph.D. students.

General Information

Programs of study can be designed for people who are employed on a full-time basis.

MCE Courses
Mechanical Engineering and Applied Mechanics

406 (or PHY 406) Atmospheric Physics I *(I, 3)*
407 (or PHY 407) Atmospheric Physics II *(II, 3)*
423 Design of Machine Elements *(I, 3)*
424 Dynamics of Machines *(I, 3)*
425 Lubrication and Bearings *(I, 3)*
426 Advanced Mechanics of Materials *(I, 3)*
427 (or ZOO 427) Modeling and Analysis of Dynamic Systems *(I, 3)*
428 Mechanical Control Systems *(II, 3)*
429 Comprehensive Design *(II, 3)*
432 Alternate Energy Systems *(I, 3)*
434 Thermal Environmental Engineering *(II, 3)*
438 Internal Combustion Engines *(I, 3)*
439 Applied Energy Conversion *(II, 3)*
448 Heat and Mass Transfer *(I, 3)*
455 Advanced Fluid Mechanics *(I, 3)*
457 Fluidics *(II, 3)*
464 Vibrations *(II, 3)*
465 Experimental Stress Analysis *(I, 3)*
466 Advanced Mechanics of Solids *(II, 3)*
491, 492 Special Problems *(I and II, 1-6 each)*

501, 502 Graduate Seminar *(I and II, 1 each)* Discussions, presentation of papers based on research, or detailed literature surveys. Attendance is required of all students in graduate residence. *(Lec. 1)* Staff

503 Linear Control Systems
See Electrical Engineering 503.

504 Optimal Control Theory
See Electrical Engineering 504.

505 Optimization in Mechanical Engineering Design *(I or II, 3)* Unified presentation of optimization techniques pertinent to mechanical engineering, emphasizing similarity of design processes for thermal systems, mechanics, and control. Finite and infinite dimensional methods. *(Lec. 3) Pre: 366 and 423 or equivalent.* Palm and Datseris

521 Reliability Analysis and Prediction *(II, 3)* Statistical analysis of failure of complex engineering systems, design factors contributing to functional system survival, failure, distribution functions, redundancy, confidence, reliability testing. *(Lec. 3) Pre: MTH 451 or equivalent, MCE 423 or permission of instructor.* Nash

523 Advanced Kinematic Analysis *(I, 3)* Centrodes, Cardanic Motion, curvature (Euler-Savary), higher curvature. Applications: plane and spherical four-bar (Universal Joint), skew four-bar. General computer programs. Intermittent mechanisms (geneva), non-circular gears, space mechanisms. *(Lec. 3) Pre: 323 or equivalent.* Datseris and Hatch

524 Advanced Kinematic Synthesis *(I, 3)* Degrees of freedom, graph theory in design, applications. Position synthesis, circle-point and center-point curves. Chebyshev Theorem. Direct, indirect and numerical optimum synthesis. Constant-velocity mechanisms. Spatial mechanisms. *(Lec. 3) Pre: 523.* Datseris and Hatch

540 Environmental Control in Ocean Engineering
See Ocean Engineering 540.

541 Thermodynamics *(I, 3)* Advanced study of classical thermodynamics with emphasis on basic concepts, laws, and thermodynamic relations. *(Lec. 3) Pre: 341, 354.* Brown, DeLuise and Wilson

542 Statistical Thermodynamics *(II, 3)* Irreversible thermodynamics, kinetic theory of gases, statistical thermodynamics, and the development and application of the partition function. *(Lec. 3) Pre: 341.* Brown and Wilson

545 Heat Transfer *(I, 3)* Conduction in two and three dimensions and conducting systems with radiation and fluid motion. Solutions obtained by mathematics, computer-numerical methods, and analog devices. *(Lec. 3) Pre: 448.* Test and Wilson

546 Convection Heat Transfer *(II, 3)* Relationship between heat transfer and fluid flow with emphasis on the solution of governing equations by exact methods, integral methods and similarity techniques. *(Lec. 3) Pre: 448.* Test

550 Theory of Continuous Media *(I, 3)* Basic course for first-year graduate students which develops and unifies the laws of mechanics as applied to the behavior of continua. Application to solids and fluids. *(Lec. 3) Pre: CVE 220, MCE 354, 372, or permission of instructor.* Sadd

551 Fluid Mechanics I *(I, 3)* Basic treatment of real fluid flows using the continuum mechanics approach. Exact solutions of the governing equations. Laminar shear flows and boundary layer theory, turbulent transition. *(Lec. 3) Pre: 354 or equivalent.* Dowdell, Hagist, Lessmann, White

552 Fluid Mechanics II *(II, 3)* Continuation of 551 including turbulent modeling, turbulent shear flows and boundary layers, incompressible irrotational flows, and selected topics such as an introduction to non-Newtonian fluid behavior, geophysical flows, or numerical methods. *(Lec. 3) Pre: 551.* Dowdell, Hagist, Lessmann, White

553 Fluid Mechanics III *(I, 3)* Two- and three-dimensional compressible flows, numerical methods for the solution of compressible and incompressible parabolic and elliptic problems. Other advanced topics of current interest. *(Lec. 3) Pre: 551 or permission of instructor.* Dowdell, Hagist, Lessmann, White

563 Advanced Dynamics *(I and II, 3)* Dynamics of a system of particles, Lagrange's equations from an advanced point of view. Variational methods, nonconservative and non-holonomic systems; matrix-tensor specifications of rigid body motions, normal coordinates. Hamilton's equation of motion, canonical transformation, Hamilton-Jacobi theory. *(Lec. 3) Pre: 463 or permission of instructor.* Datseris and Nash

564 Advanced Vibrations *(I, 3)* Theory of vibration of systems with concentrated masses and stiffness; systems with one degree of freedom, vibration isolation systems with many degrees of freedom, matrix methods, dynamic vibration absorbers, torsional vibration, approximate numerical methods. Experimental methods and design procedures. *(Lec. 3) Pre: 464.* Halliday, Palm and Nash

565 Advanced Vibrations *(II, 3)* Theory of vibration with continuously distributed mass and stiffness. Wave, characteristic function and integral equation methods of solution of string, longitudinal and torsional systems. Vibration and critical speeds of beams and rotating shafts, the methods of Rayleigh, Ritz, and Stodola, and self-excited vibrations. *(Lec. 3) Pre: 564.* Halliday and Nash

571 Theory of Elasticity I *(I, 3)* Development of the basic field equations; generalized Hooke's law; general concepts of stress and strain; plane problems; stress functions; Saint Venant torsion and flexure; introduction to three-dimensional problems. *(Lec. 3) Pre: CVE 220 or equivalent.* Sadd, Kim, and Shukla

572 Theory of Elasticity II *(II, 3)* Continuation of 571, including advanced topics selected from: complex variable methods; displacement potentials and stress functions for three-dimensional problems; thermoelasticity; variational, approximate, and numerical methods; anisotropic solutions. *(Lec. 3) Pre: 571 or equivalent.* Sadd, Kim, and Shukla

573 Theory of Plates *(I and II, 3)* Theory of plates and application to plates of various shapes under various loadings. *(Lec. 3) Pre: CVE 220, MTH 244, MCE 372, or permission of instructor.* Kim and Nash

574 Energy Methods in Solid Mechanics *(II, 3)* Introduction to calculus of variations, variational principles in solid mechanics, and approximate solution techniques; static and dynamic application involving beams, frames, plates. *(Lec. 3) Pre: 550.* Kim

575 Elastic Stability *(I and II, 3)* Stability analysis of bars under separate and combined axial, lateral, and torsional loadings; buckling of plates and shells, energy methods, and numerical methods. *(Lec. 3) Pre: CVE 220, MTH 244, MCE 372, or permission of instructor.* Goff, Kim

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

646 (or CHE 646) Radiation Heat Transfer *(I or II, 3)* Radiant exchange between surfaces. Radiative properties of surfaces. Exchange among non-ideal surfaces. Gas-radiative exchange. Radiative exchange with volume emitters. Furnace design applications. *(Lec. 3) Pre: 545 or CHE 644 or permission of instructor.* Brown

651 Turbulent Flows *(I, 3)* Turbulent flows from both the phenomenological and statistical points of view. Applications to meteorology, boundary layers and turbulent diffusion. *(Lec. 3) Pre: 551 or permission of instructor.* Hagist

652 Experimental Methods in Fluid Mechanics *(II, 3)* An overview of measurement techniques and instrumentation used in the current practice of experimental fluid mechanics. Course emphasizes hot wire, hot film, and laser anemometry. Provides practical laboratory experience. *(Lec. 2, Lab. 3) Pre: 551 or permission of instructor.* Hagist and Lessmann

666 Nonlinear Mechanics *(I and II, 3)* Dynamics of nonlinear systems, free and forced oscillations; graphical methods, integral curves, singular points, limit cycles and stability. Van der Pol equation, perturbation methods, approximate methods, ap-

plication to ecological systems. *(Lec. 3) Pre: 564.* Nash

673 Thermal Stress Analysis *(I, 3)* Theory of stress and deformation in bodies subjected to thermal environments and restraints. Application to problems in thermoelasticity, thermal fatigue, thermoplasticity, and creep analysis. *(Lec. 3) Pre: 448, 550.* Kim and White

674 Theory of Shells *(I and II, 3)* Development and application of membrane and bending theories of shells of various shapes. Variational methods and buckling of shells. *(Lec. 3) Pre: CVE 220, MCE 573, or permission of instructor.* Kim

677 Fatigue Failure and Fracture Mechanics *(II, 3)* Advanced study of fracture induced by repeated loading, damage theories, fundamental theories of microscopic crack initiation and growth, statistical aspects of fatigue failure, theory of crack propagation. *(Lec. 3) Pre: 429, 550, MTH 451, or permission of instructor.* Nash, Sadd, and Ghonem

679 Plasticity and Creep *(II, 3)* Stress-induced flow of nominally solid materials, effect of temperature, combined stress problems; stress-dependent creep of metals at elevated temperatures, creep buckling, anelastic creep, related dislocation theory. *(Lec. 3) Pre: 550 or permission of instructor.* Sadd

691, 692 Special Problems *(I and II, 1-6 each)* Advanced work, under the supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problem.) Credits not to exceed a total of 12. Pre: permission of department.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Medicinal Chemistry

M.S. Ph.D. (Pharmaceutical Sciences)

Graduate Faculty

Acting Chairperson: Professor Leonard R. Worthen, Ph.D., 1957, University of Massachusetts
Professor Elie Abushanab, Ph.D., 1965, University of Wisconsin
Professor Joseph G. Turcotte, Ph.D., 1967, University of Minnesota
Associate Professor Raymond P. Panzica, Ph.D., 1972, University of Utah
Professor Charles I. Smith, Ph.D., 1950, University of Maryland
Professor Emeritus Howard W. Bond, Ph.D., 1941, University of Illinois

Specializations

Design and synthesis of medicinal agents, including anthelmintics, chemotherapeutic agents (ex. antitumor and antiviral), complex lipids, hypotensives, and metabolite antagonists; development of methods of drug analysis including high performance liquid chromatography and $^{1}H/^{13}C$ nuclear magnetic resonance spectroscopy; drug instabilities.

Master of Science

Admission requirements: GRE, and bachelor's degree in pharmacy, chemistry, biochemistry, or allied sciences.

Program requirements: thesis; A.C.S. placement examination (organic) to determine specific program requirement; CHM 431, 432, or BCP 435 or equivalent; CHM 425, 427 and 521 or 522; MCH 443, 444 or equivalent; MCH 548, 621, 622. All students must register for and attend seminar each semester while in graduate residence. Each student will present one seminar per semester unless otherwise indicated by the majority of the departmental faculty.

Doctor of Philosophy (Pharmaceutical Sciences)

Admission requirements: GRE, and master's degree in pharmacy, chemistry, biochemistry, or allied sciences or bachelor's degree in one of these with evidence of superior ability.

Program requirements: dissertation; A.C.S. placement examination (organic) to determine specific program requirement; same as for master's degree plus CHM 521 and 522; also MCH 501, 533, and 549 recommended; reading proficiency in French, German, or Russian to be demonstrated before taking written and oral comprehensive examinations; primary emphasis in organic, medicinal chemistry and pharmaceutical analysis.

Qualifying examination is required for candidates accepted without M.S. degree.

MCH Courses
Medicinal Chemistry

443, 444 Organic Medicinal Chemistry *(I and II, 3 each)*

497, 498 Special Problems *(I and II, 1-5 each)*

501 Radiopharmaceuticals *(I, 3)* The theoretical and applied aspects of the commonly used isotopes of pharmaceutical significance with emphasis on the diagnostic, therapeutic, and tracer applications in biological systems and techniques of development, formulation, quality control, and safe utilization. *(Lec. 2, Lab. 3) Pre: CHM 228 and PHY 112, or permission of department.* Smith

526 Lipid Chemistry
See Food Science and Technology 526.

533 Advanced Drug Assay *(I and II, 2-4)* Advanced chemical and physical methods of analytical control related to pharmaceutical research and industrial pharmacy. *(Lec. 1, Lab. 3-9) Pre: 342.* Smith

548 (or PCG 548) Physical Methods of Identification *(II, 3)* Utilization of physical methods (primarily spectroscopic) in the structure elucidation of complex organic molecules. Emphasis on interpretation of ultraviolet, infrared, nuclear magnetic resonance, mass, and optical rotatory dispersion spectra. *(Lec. 3) Pre: CHM 425 and/or permission of instructor.* Staff

549 Synthesis *(I and II, 3)* Theoretical and applied aspects in synthesis of selected organic compounds of medicinal significance. *(Lab. 9) Pre: permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

621, 622 Seminar *(I and II, 1 each)* Seminar discussions including student presentations of papers on selected topics in medicinal chemistry. *(Lec. 1) No more than 3 credits will be allowed toward program credit. S/U credit.* Staff

643 Advanced Organic Medicinal Chemistry *(II, 3)* Synthesis, modes of action, and effects on pharmacological activity. Analgesics, cholinergics, folic acid antagonists, diuretics, and sulfonamides are included. *(Lec. 3) Pre: CHM 522 and permission of instructor. In alternate years, next offered 1983-84.* Staff

646 Alkaloids *(I, 3)* Advanced course dealing with proof of structure, synthesis, chemical properties, and biological activity of various alkaloids. *(Lec. 3) Pre: permission of department.* Abushanab

697, 698 Research in Medicinal Chemistry *(I and II, 1-3 each)* Literature survey, laboratory work, and a detailed research report on one or more assigned topics in medicinal chemistry. *(Lab. 3-9) Pre: permission of department.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Microbiology

M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor Norris P. Wood, Ph.D., 1955, University of Pennsylvania
Professor Victor J. Cabelli, Ph.D., 1951, University of California, Los Angeles
Professor Paul S. Cohen, Ph.D., 1964, Boston University
Professor Harold W. Fisher, Ph.D., 1959, University of Colorado
Professor John M. Sieburth, Ph.D., 1954, University of Minnesota
Professor Richard W. Traxler, Ph.D., 1958, University of Texas
Associate Professor Linda A. Hufnagel, Ph.D., 1967, University of Pennsylvania
Associate Professor David C. Laux, Ph.D., 1971, University of Arizona
Assistant Professor David R. Nelson, Ph.D., 1979, University of California, Los Angeles
Assistant Professor Jay F. Sperry, Ph.D., 1974, University of Kansas
Adjunct Associate Professor Jan C. Prager, Ph.D., 1961, New York University
Professor Emeritus Philip L. Carpenter, Ph.D., 1937, University of Wisconsin

Specializations

Medical microbiology: pathogenesis, immunology, mycology, virology, tumor immunology.

Microbial genetics, physiology, molecular microbiology: transcriptional and translational control mechanisms, messenger RNA metabolism in procaryotes and eucaryotes, virus multiplication, control of transport and metabolism, mechanisms of survival, membrane structure.

Cell biology, cellular development, ultrastructure: ciliogenesis in protozoa, electron microscopy, ultrastructure of electrically conducting systems, cell culture, cellular immunity.

Microbial ecology, industrial microbiology, pollution: marine and fresh water microbial ecology, biodeterioration, sanitary bacteriology, coliform ecology.

Master of Science

Admission requirements: GRE and two semesters each of introductory courses in biology (zoology, botany), inorganic and organic chemistry, mathematics, and physics; a semester each of microbiology, genetics, quantitative analysis, and biochemistry.

Program requirements: thesis; BCP 581; MIC 411, 599, 695, and 696; major portion of courses in microbiology, including one from an area other than bacteriology (virology, mycology, phycology, cell biology, protozoology); written comprehensive examination.

Doctor of Philosophy (Biological Sciences)

Admission requirements: same as for master's degree and two semesters of calculus, BCP 435, and statistics. Proficiency in one foreign language may be required by the student's major professor. Master's degree normally required; outstanding candidates may be accepted without an M.S. degree.

Program requirements: same as for master's degree plus BCP 582; MIC 533, 552, and dissertation. A course in microbial physiology (MIC 641, BOT 534, OCG 663 or equivalent). Of the credits earned beyond the master's degree, 18 should be in coursework. Qualifying examination is required. Prior to the last semester, the candidate must pass written and oral comprehensive examination in the major areas of microbiology.

MIC Courses
Microbiology

401 (or BCP 401) Quantitative Cell Culture *(I, 3)*
403 (or BCP 403) Introduction to Electron Microscopy *(I, 2)*
405 (or BCP 405) Electron Microscopy Laboratory *(I, 2)*
410 (or ZOO 410) Introduction to Protistology *(II, 3)*
411 Advanced Bacteriology *(I, 4)*
412 Food Microbiology *(II, 3)*
422 (or PLP 422) Industrial Microbiology *(II, 3)*
432 Pathogenic Bacteriology *(II, 3)*
453 (or BOT 453) Cell Biology *(II, 3)*
495, 496 Seminar in Microbiology *(I and II, 1 each)*

510 (or ZOO 510) Cell and Developmental Biology of the Motile Protista *(II, 2)* Introduction to the motile protista as eucaryotic cells. Emphasis on experimental methods, including brightfield, phase contrast, Nomarski, and fluorescence microscopy; cytochemistry; culturing; organelle isolation; genetics; synchronization of development; motility. *(Lab. 4) Pre: prior or concurrent enrollment 410 or permission of instructor.* Hufnagel

521 (or BOT 521 or ZOO 521) Recent Advances in Cell Biology *(I, 2)* Reading of current papers in the area of cell biology and preparation of written and oral reports. Emphasis on animal cells. *(Lec. 2) Pre: at least one of the following courses or an equivalent course emphasizing cell structure and function: ZOO 315, 441, BOT 453, 432, 445, and MIC 408; graduate status or permission of instructor. May be repeated, maximum four credits.* Hufnagel, Swanson, and Goertemiller

533 Immunity and Serology *(I, 3)* Various immune reactions, nature of antigens and antibodies, and formation and action of latter. *(Lec. 2, Lab. 3) Pre: 201 or 211 and one semester of organic chemistry and senior standing.* Staff

552 Microbial Genetics *(II, 3)* Recent research on the mechanisms of mutation and genetic recombination, the process of DNA replication, the genetic code, and regulation of DNA, RNA, and protein synthesis in microorganisms. *(Lec. 2, Lab. 3) Pre: 201, BOT 352, and BCP 311.* Cohen

576 Marine Microbiology
See Oceanography 576.

593, 594 The Literature of Bacteriology *(I and II, 1 each)* Thorough study of original literature of some phase of bacteriology. Written abstracts or papers on assigned topics are discussed in weekly conferences with instructor. *(Lec. 1-2)* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

621 Systematic Bacteriology *(I, 4)* Conferences, assigned readings, and laboratory work designed to give a knowledge of principles of classification of bacteria as well as methods of identifying and describing unknown species. *(Lec. 3, Lab. 3) Pre: 432 and either 412 or 533. In alternate years, next offered 1981-82.* Staff

622 (or BCP 622) Advanced Electron Microscopy *(II, 2)* The physical functioning of electron microscopes; high resolution microscopy of macro-molecules; newly available EM histochemical procedures; and computer processing of electron images. *(Lec. 2) Pre: 403, 405 or permission of department.* Hufnagel

624 (or BCP 624) Advanced Electron Microscopy Laboratory *(II, 2)* Cleaning and aligning the electron microscope; development of independent project utilizing advanced techniques, and formal presentation of results of individual projects to the class. *(Lab. 6) Pre: prior or concurrent registration in 622 or permission of department.* Hufnagel

641 Physiology of Bacteria *(II, 4)* Bacterial structure and function, including growth, nutrition, environmental factors, metabolism, biosynthesis, and energy-yielding reactions. *(Lec. 3, Lab. 3) Pre: 201 or 211, 2 semesters of organic chemistry and one semester of biochemistry. In alternate years, next offered 1982-83.* Wood

654 Advances in Immunology *(II, 2)* Reports on assigned readings concerning latest developments in the field of cellular and humoral immunity presented and discussed by students. Research paper and critical review of a scientific paper required. *(Lec. 2) Pre: 553, BCP 311, or permission of instructor. May be repeated maximum four credits. In alternate years, next offered 1983-84.* Laux

656 Mechanisms of Bacterial Pathogenesis *(I, 4)* Study of recent research on the mech-

anisms of pathogenesis. Students expected to participate in roundtable discussions of recent pertinent literature. *(Lec. 3, Lab. 3) Pre: 432, 552, BCP 311. In alternate years, next offered 1982-83.* Staff

691, 692 Special Problems in Microbiology *(I and II, 3)* Assigned research on an advanced level. Student required to outline problem, conduct the necessary literature and experimental work, and present observations and conclusions in a report. *(Lab. 6) Pre: graduate standing.* Staff

695, 696 Graduate Research Seminar *(I and II, 1 each)* Reports of research in progress or completed. *(Lec. 1) Required of all graduate students in microbiology. S/U credit.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Note: for Virology, see Aquacultural Science and Pathology and Plant Pathology; for Mycology, see Botany.

Music

M.M.

Graduate Faculty

Chairperson: Professor John R. Heard, M.M., 1970, Catholic University of America
Professor Joseph S. Ceo, D.M.A., 1976, Catholic University of America
Professor Albert C. Giebler, Ph.D., 1957, University of Michigan
Professor George E. Kent, M.M., 1960, New England Conservatory of Music
Professor Arthur Motycka, Ed.D., 1965, University of Illinois
Professor W. Donald Rankin, D.M.A., 1970 Boston University
Associate Professor John D. Dempsey, M.M., 1964, Eastman School of Music, University of Rochester
Associate Professor Henry C. Fuchs, M.Mus., 1961, University of Michigan
Associate Professor Geoffrey D. Gibbs, D.M.A., 1974, Eastman School of Music
Associate Professor Gene J. Pollart, M.M., 1967, University of Colorado
Assistant Professor Ora E. Wry, D.M.A., 1976, Temple University
Assistant Professor Mary L. Langdon

Specializations

Music with interest options in several categories: (A) performance, (B) performance/essay, (C) musical aesthetics, (D) sociology of music, or (E) thesis.

Master of Music

Admission requirements: undergraduate major in music (option B also requires considerable studio teaching experience or, as in options C-E, an undergraduate degree in music education) with a grade point average of 2.5 or above, GRE with advanced test in music. Applicants must indicate an option preference and for concentrations in performance or performance/essay pass an audition in their major performance subject before acceptance into the program.

Program requirements: entrance placement examinations in music history, literature and theory determine whether background deficiencies must be made up for no graduate program credit. A post-admission audition is given to help in choosing electives.

The performance option requires twelve credit hours in MUS 561 culminating in a public recital (MUS 565), MUS 548, and six credits distributed as follows according to the major performance subject: *for pianists,* MUS 481, 482 and two credits in 598; *for vocalists,* MUS 483, 484 and two credits in 598; *for performers on guitar, organ or recorder,* two credits in 598, one credit in ensemble elective and three credits of music electives; *for other instrumentalists,* MUS 512, two credits in 598 and one credit of ensemble elective.

Options in performance/essay, musical aesthetics, sociology of music or thesis require as prerequisite MUS 537, 540, 545 and 548. In addition, the performance/essay option requires six credit hours in MUS 551 culminating in a public recital (MUS 555) and an essay (MUS 570); the musical aesthetics option requires PHL 455, 555, and an essay (MUS 570); the sociology of music option requires SOC 422, 446, and an essay (MUS 570); and the thesis option requires six credit hours in MUS 599 and one three-hour elective.

All options require a minimum of nine hours of electives taken from music history and literature, theory and composition, and/or performance (no more than six hours in any one of the three areas), and performance only if the performance/essay or performance options are not selected. Students in the thesis option must pass qualifying examinations given between 15 and 24 credit hours. Students in non-thesis options must pass written comprehensive examinations.

MUS Courses
Music

407 The Symphony *(II, 3)*
408 The Opera *(II, 3)*
418 Composition *(II, 3)*
419 Composition *(I, 2)*
420 Counterpoint *(II, 3)*
422 Advanced Orchestration *(II, 2)*
423 Sixteenth Century Counterpoint *(II, 3)*
430 The Renaissance Period *(I, 3)*
431 The Baroque Era *(I, 3)*
432 The Classical Era *(II, 3)*
433 The Romantic Era *(I, 3)*
434 The Modern Era *(I, 3)*
438 Topics in Elementary School Music *(I, 3)*
441 Special Projects *(I and II, 3)*
446 Teaching General Music *(II, 3)*
481, 482 Piano Literature and Pedagogy *(I and II, 2 each)*
483, 484 Vocal Literature and Pedagogy *(I and II, 2 each)*
485 Opera Workshop *(I and II, 1)*
496 Jazz Workshop *(SS, 1)*
499 Pedagogy of String Instruments and Performance of String Literature *(SS, 4)*

512 Advanced Instrumental Conducting *(I, 3)* Critical study of orchestral and chamber music scores with reference to interpretation and performance. Development of technical command and expressive skill. Includes supervised rehearsal and conducting of university ensembles. *(Lec. 3) Pre: knowledge of basic baton as evidenced in audition or 312.* Ceo

537 Musical Thought and Expression *(I, 3)* Selected major readings from philosophical foundations of music, including aesthetics and psychology. Intensive study and projects related to musical performance practices. *Pre: graduate standing in music. (Lec. 3)* Motycka and Staff

540 Advanced Principles of Music Education *(II, 3)* Critical study of principles of objectives, program, method, administration, supervision, and evaluation of music education in the United States. *(Lec. 3)* Motycka

545 Musical Aptitude and Achievement *(I, 3)* Intensive analysis of musical aptitude and achievement, from a thorough examination of existing devices to the consequent realization of research data via basic statistical concepts. *(Lec. 3) Pre: graduate standing in music, EDC 371 or PSY 434 or equivalent.* Motycka

548 Research in Music *(II, 3)* Examination of research techniques as applied to the art of music. Extant major project procedures and data in the research categories: historical, analytical, experimental, descriptive, and philosophical. *(Lec. 3) Pre: 545 or permission of department.* Motycka

551 Performance as Minor or Elective *(I and II, 2)* Private instruction. One 50-minute lesson and scheduled practice hours each week. One level, one year as prescribed in performance minor syllabi. Afternoon recital required each semester. *(Studio 6) Pre: completion of performance minor in undergraduate upper division and permission of department. May be repeated.* Staff

Select area of instruction from the following and add to course number as MUS 551B, Piano:

A Voice
B Piano
C Organ
D Harpsichord
E Violin
F Viola
G Violoncello
H Bass Viol
I Viola d'Amore
J Flute
K Oboe
L Clarinet
M Bassoon
N Saxophone
P Trumpet
Q French Horn
R Trombone
S Baritone Horn
T Tuba
U Percussion
V Guitar
W Harp

555 Graduate Recital for Performance Minor *(I and II, 0)* Performance of advanced repertoire of various styles in a public program of at least 45 minutes performance time after faculty acceptance. *Pre: concurrent registration in 551 and 4 or more credits in 551.* Staff

561 Performance Major *(I or II, 4 or 6 each)* Private instruction for graduate performance concentrators only. One 60 minute lesson each week. Recital performance as required by department and instructor. *(Studio 60 minutes)* See under 551 for areas of instruction. *Pre: audition demonstrating proficiency and comprehension equivalent to that required for the completion of the B.M. in performance. May be repeated.* Staff

565 Graduate Recital for Performance Major *(I and II, 0)* Performance of advanced repertoire of various styles in a public program of at least 55 minutes performing time after faculty acceptance. *Pre: concurrent registration in 561 and 6 or more credits in 561.* Staff

570 Graduate Project *(I and II, 3)* Independent study resulting in a major essay, composition, or orchestration. *Pre: 548 and permission of department.* Staff

590 Piano Accompanying *(I and II, 1)* Development of sightreading skills. Preparation and performance of accompaniments of major works. *(Lec. 1) Pre: permission of piano faculty. May be repeated for a total of three program credits.* Rankin

591 University Symphony Orchestra *(I and II, 1 each) (Lec. 3) Pre: audition at graduate level of performance. May be repeated.* Ceo

594 Symphonic Wind Ensemble *(II, 1) (Lec. 3) Pre: audition at graduate level of performance.* Pollart

595 Concert Choir *(I and II, 1 each) (Lec. 3) Pre: audition at graduate level of performance.* Kent

596 Jazz and Studio Ensemble *(I and II, 1)* Study and performance of jazz and studio music, with leadership roles in improvisation and sectional rehearsals and performance. Demonstration of technical and stylistic competencies for these roles in audition. *(Lab. 3)* Motycka

598 Chamber Music Ensemble *(I and II, 1 each)* Chamber music ensembles are designated as A. Keyboard Ensemble, B. String Ensemble, C. Woodwind Ensemble, D. Brass Ensemble, E. Percussion Ensemble, G. Madrigal Singers, H. Guitar Ensemble, M. Jazz Combo. Select appropriate letter and small ensemble from the list and add to course number, as 598B String Ensemble. Other ensemble combinations may be added. Small instrumental ensembles are normally restricted to one performer per part *(Lec. 2) Pre: graduate standing in music and evidence by audition of graduate level performance. May be repeated.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. *May be repeated.* Staff

Nursing

M.S.

Graduate Faculty

Dean: Professor Barbara L. Tate, R.N., Ed.D., 1961, Teachers College, Columbia University
Assistant Dean: Associate Professor Myrtle P. Matejski, R.N., Ph.D., 1977, University of Maryland
Professor Grayce Garner, R.N., Ed.D., 1963, Columbia University, Teachers College
Professor Hesook Kim, R.N., Ph.D., 1977, Brown University
Associate Professor Concepcion Y. Castro, R.N., M.S., 1959, University of Colorado
Associate Professor Roberta B. Feather, Ed.D., 1980, Boston University
Associate Professor Janet I. Hirsch, R.N., Ed.D., 1978, Boston University
Associate Professor Donna Schwartz-Barcott, R.N., Ph.D., 1978, University of North Carolina
Assistant Professor Claire M. Manfredi, R.N., Ed.D., 1976, Teachers College, Columbia University

Specializations

Education, administration, mental health care, and primary health care.

Master of Science

Admission requirements: MAT or GRE, a bachelor's degree from an NLN-accredited program with an upper division major in nursing and an undergraduate course in statistics. For the area of concentration in primary health care: two years of professional nursing practice and NUR 495 or equivalent are required. Students who have not completed upper division undergraduate nursing coursework will be required to make up this deficiency prior to completion of the admission process.

Program requirements: 36 credit hours for areas of concentration in education, administration, and mental health; 39 credit hours for primary health care concentration. This includes NUR 501, 502, 505, 510; 12-15 credits in area of concentration (NUR 521, 522, 541, 542 for education; NUR 521, 522, 551, 552 for administration; NUR 511, 512, 513, 514 for mental health care, and NUR 531, 532, 533, 534 for primary health care); 3 credits in physiological sciences, 3 credits in social/behavioral sciences, 3 credits related to area of concentration, and 3 credits of free elective; major paper involving independent research; written comprehensive examination.

NUR Courses
Nursing

495 Expanded Nursing Assessment Skills *(I or II, 3)*

501 Theoretical Study of Phenomena in Nursing *(I or II, 3)* Major theories and concepts in nursing. Emphasis on the theoretical study of nursing phenomena commonly found in client and client-nurse systems. *(Lec. 3) Pre: graduate standing, must be taken concurrently with 502.* Kim, Schwartz-Barcott, and Hirsch

502 Practicum in the Study of Phenomena in Nursing *(I or II, 3)* Field study of selected nursing phenomena in health care agencies. Emphasis on the clinical application of selected theoretical or conceptual frameworks. *(Lab. 6) Pre: graduate standing, must be taken concurrently with 501.* Kim, Schwartz-Barcott, and Hirsch

505 Nursing Research *(I or II, 3)* An overview and study of nursing research. Emphasis on the analysis of current research in nursing focusing on patient care. Research skills developed further by designing a research project. *(Lec. 3) Pre: graduate standing and a course in statistics.* Kim, Schwartz-Barcott and Hirsch

506 Independent Study in Nursing *(I and II, 2-6)* Intensive study of a specific area of interest, a problem or issue in nursing under guidance of the faculty. *Pre: permission of graduate faculty.* Staff

510 Advanced Leadership and Nursing Role Development *(II, 3)* Factors at various levels of social institutions that influence client and client-nurse systems. Emphasis on role development, leadership, and change in effecting patient care. *(Lec. 3) Pre: graduate standing.* Manfredi

511 Advanced Mental Health Nursing I *(I or II, 3)* Investigation of theories of healthy and psychopathological patterns of individual behavior from a mental health perspective. *(Lec. 3) Pre: 501 and 502, graduate level course in psychoneurology or psychobiology, must be taken prior to or concurrently with 512.* Garner and Feather

512 Practicum in Advanced Mental Health Nursing I *(I or II, 3)* Field experience to develop competence in the practice of

advanced mental health nursing. Emphasis on application of relevant theories in solving individuals' mental health problems. *(Lab. 6) Pre: 501 and 502, graduate level course in psychoneurology, must be taken concurrently with 511.* Feather and Garner

513 Advanced Mental Health Nursing II *(I or II, 2)* Theoretical analysis of current modes of advanced mental health intervention in order to explain strategies for solution of family, group, and community problems. *(Lec. 2) Pre: 511, 512, must be taken concurrently with 514.* Garner

514 Practicum in Advanced Mental Health Nursing II *(I or II, 4)* Field experience to develop increased competence in the practice of mental health nursing intervention. *(Lab. 8) Pre: 511, 512, must be taken concurrently with 513.* Feather and Garner

521 Theoretical Study of Major Problems in Nursing Practice *(II, 3)* Major theories and concepts for developing strategies in nursing practice. Emphasis on developing nursing strategies through theoretical analysis of problems viewed in the context of organizational and societal systems. *(Lec. 3) Pre: 501, 502 and 505, must be taken concurrently with 522.* Schwartz-Barcott and Kim

522 Practicum in the Study of Major Problems in Nursing Practice *(II, 3)* Field study of major nursing problems with emphasis on examination, evaluation, and revision of nursing strategies for problems in the context of organizational and societal systems. *(Lab. 6) Pre: 501, 502 and 505, must be taken concurrently with 521.* Schwartz-Barcott and Kim

531 Primary Health Care Nursing I *(I or II, 3)* Theoretical knowledge and skills for the development of nursing strategies in analyzing, managing, and preventing health-related problems common to primary health care clients as individuals. *(Lec. 3) Pre: 500, 501, 502, ZOO 442.* Castro

532 Practicum in Primary Health Care Nursing I *(II, 3)* Clinical application of theoretical knowledge and skills as presented in 531. *(Lab. 6) Pre: must be taken concurrently with 531.* Castro

533 Primary Health Care Nursing II *(I, 3)* Theoretical study for the development of increased nursing competency in primary care practice. Emphasis on health care strategies to assist individuals and families in coping with health-related problems. *(Lec. 3) Pre: 531, 532, must be taken concurrently with 534.* Castro

534 Practicum in Primary Health Care Nursing II *(I, 6)* Application of theoretical knowledge skills for the development of nursing strategies for health promotion and management of health-related problems common to families. *(Lab. 12) Pre: 531, 532, must be taken concurrently with 533.* Castro and O'Flynn

541 Theoretical Study of Nursing Education *(I or II, 3)* Investigation of theories, concepts, and models applicable to nursing education. Emphasis on theoretical analysis to develop and explain strategies for the teaching of nursing. *(Lec. 3) Pre: 521, 522 or permission of the instructor, must be taken concurrently with 542.* Hirsch

542 Practicum in Nursing Education *(I or II, 3)* Field experience in nursing education. Emphasis on the instructional design and the development of strategies for the teaching of nursing based on theoretical knowledge. *(Lab. 6) Pre: 521, 522 or permission of instructor, must be taken concurrently with 541.* Hirsch

551 Theoretical Study of Nursing Administration *(I or II, 3)* Study of theories of organization and management as they relate to nursing administration. The emphasis is on theories to develop or explain management strategies in nursing administration. *(Lec. 3) Pre: 521, 522 or permission of instructor, must be taken concurrently with 552.* Manfredi

552 Practicum in Nursing Administration *(I or II, 3)* Field experience in nursing administration. Emphasis on the examination, development and implementation of strategies in nursing administration. *(Lab. 6) Pre: 521, 522 or permission of instructor, must be taken concurrently with 551.* Manfredi

995 Reading and Research in Nursing *(I or II, 1-6)* Advanced work by individual student on a selected issue in nursing under the direction of a faculty member. *(Lec. 1-6) Not for program credit. Pre: graduate standing.* Staff

Ocean Engineering

M.S., Ph.D.

Graduate Faculty

Chairperson: Professor Foster H. Middleton, Dr.Eng., 1959, The Johns Hopkins University
Professor Robert S. Haas, M.S., 1965, Northeastern University
Professor Tadeusz Kowalski, Ph.D., 1969, University of Waterloo
Professor Lester R. LeBlanc, Ph.D., 1966, University of Rhode Island
Professor Vito A. Nacci, M.S., 1949, Harvard University
Professor Armand J. Silva, Ph.D., 1965, University of Connecticut
Professor Peter R. Stepanishen, Ph.D., 1969, Pennsylvania State University
Professor Frank White, Ph.D., 1959, Georgia Institute of Technology
Associate Professor M. Fadhil Al-Kazily, Ph.D., 1972, University of California, Berkeley
Associate Professor John M. Niedzwecki, Ph.D., 1977, Catholic University of America
Associate Professor Vincent C. Rose, Ph.D., 1964, University of Missouri
Associate Professor Malcolm L. Spaulding, Ph.D., 1972, University of Rhode Island
Assistant Professor Peter C. Cornillon, Ph.D., 1973, Cornell University
Adjunct Professor Larry A. Mayer, Ph.D., 1979, University of California
Professor Emeritus Herman E. Sheets, Doctor of Tech. Sci., 1936, Technical University, Prague

Specializations

Underwater acoustics, hydrodynamics, data collection and analysis, ocean energy systems, materials and corrosion, marine geomechanics, numerical modeling of ocean processes, and marine structures.

Master of Science

Admission requirements: GRE and B.S. degree in engineering, physics, applied mathematics or other technical disciplines. Students with a non-engineering background may be required to make up deficiencies by taking undergraduate courses in thermodynamics, fluid flow, strength of materials, electrical engineering, or applied mathematics. Applications should be submitted as early in the senior year as possible.

Program requirements: thesis and three courses selected from OCE 512, 521 or 534, 560 or 561, 565, 571, 587, 610, 653; one course selected from OCG 501, 521, 540, 561; and at least 12 course credits of electives.

Doctor of Philosophy

Admission requirements: GRE and M.S. degree and master's thesis in engineering or other technical discipline, or equivalent; ocean engineering and oceanography core courses as in master of science program. Requirements must have been taken previously or will have to be made up for no program credit.

Program requirements: Ph.D. qualifying examination, dissertation, one advanced applied mathematics course, one additional oceanography and two additional ocean engineering core courses, completion of 30 course credits beyond master's.

Special Financial Aid

Graduate and research assistantships are available for highly qualified students. Some industrial and other fellowships are also available.

General Information

Programs of study can be designed for people who are employed on a full-time basis.

OCE Courses
Ocean Engineering

401, 402 (or MCE 401, 402) Introduction to Ocean Engineering Systems I and II *(I and II, 3 each)*

403, 404 (or CHE 403, 404) Introduction to Ocean Engineering Processes I and II *(I and II, 3 each)*

410 (or MCE 410) Basic Ocean Measurements *(I and II, 3)*

500 Basic Ocean Engineering *(II, 3)* Introduction for non-engineering students to the classic engineering disciplines as they relate to marine affairs. Course is descriptive and deals with current engineering practice. *(Lec. 3) Pre: senior standing. No program credit for graduate engineering students. Offered in even calendar years.* Staff

512 Hydrodynamics of Floating and Submerged Bodies I *(I, 3)* Hydrodynamic principles associated with floating and submerged bodies: resistance, propulsion, static and dynamic stability. *(Lec. 3) Pre: MCE 455 or equivalent.* Kowalski

513 Hydrodynamics of Floating and Submerged Bodies II *(II, 3)* Continuation of 512. Problems of maneuvering, control and motions in waves. *(Lec. 3) Pre: MCE 455 or equivalent.* Kowalski

521 Materials Technology in Ocean Engineering *(I, 3)* Requirements for ocean engineering materials. Material characteristics, fracture toughness, notch sensitivity, energy absorption, speed of loading, and fatigue in salt water. Steel, aluminum, titanium, plastics, concrete, and applicable regulations. *(Lec. 3) Pre: permission of instructor.* Staff

524 Marine Structural Design
See Civil Engineering 524.

534 (or CHE 534) Corrosion and Corrosion Control *(II, 3)* Chemical nature of metals, electrochemical nature of corrosion. Types of corrosion, influence of environment, methods of corrosion control, behavior of engineering materials, all with special emphasis on the ocean environment. *(Lec. 3) Pre: permission of instructor.* Staff

535 (or CHE 535) Advanced Course in Corrosion *(II, 3)* Various types of corrosion problems occurring in modern industry. In-depth comparison of the various methods available to avoid, reduce, or eliminate corrosion. Continuation of 534. *(Lec. 3) Pre: 534 or permission of instructor.* Staff

540 (or MCE 540) Environmental Control in Ocean Engineering *(II, 3)* Application of the principles of thermodynamics, heat transfer, and fluid dynamics to the requirements of human survival and engineering operations in deep and shallow water. *(Lec. 3) Pre: permission of instructor.* Schenck

555, 556 Ocean Energy Systems I and II *(I and II, 3 each)* Theory and design of energy extraction from the oceans. Types of ocean power available; principles and systems of energy extraction; design and construction principles. Design project of a power device will be carried out in the second semester. *(Lec. 3) Pre: MCE 345 and 354 or equivalent.* Kowalski

560 Introduction to Data Collection Systems *(I, 3)* Practical problems of data collection. Probes and sensors, interfaces, signal conditioning, and storage. Examples found among the current research areas within ocean engineering will be emphasized. *(Lec. 3) Pre: graduate standing in engineering or permission of instructor.* Haas

561 Introduction to the Analysis of Oceanographic Data *(I, 3)* Design of oceanic experiments to determine spatial and temporal sampling rate, recision, accuracy, signal-to-noise ratio, etc. Description of typical ocean data collection and analysis systems. Development of relevant techniques. *(Lec. 3) Pre: IDE 411, MTH 451 or equivalent.* LeBlanc

565 Ocean Laboratory I *(I or II, 3)* Measurements, experiments, operation of apparatus in the ocean and in the laboratory. Statistical theory, planning multivariable experiments, checking of data, etc. *(Lec. 1, Lab. 6) Pre: graduate standing in engineering or oceanography, or permission of instructor.* Middleton

566 Ocean Laboratory II *(I or II, 3)* Planning long-term experiments in the ocean. Carrying out a synoptic ocean program using vessels, buoys, underwater sensors and locations of opportunity. Student manages experiment, and writes technical report. *(Lab. 6-8) Pre: 565.* Middleton

571 (or ELE 571) Underwater Acoustics I *(I, 3)* Wave equation, energy, pressure and particle velocity. Acoustic properties of the sea. Elementary sources, refraction, reflection, ray theory, normal modes, and scattering, with emphasis on sound propagation in the ocean. *(Lec. 3)* Stepanishen

587 Submarine Soil Mechanics *(I, 3)* Soil mechanics principles as applied to submarine slope stability, heaving, sinkage, and anchorage problems with emphasis on effective stress principle and selection of shear strength of marine sediments *(Lec. 3) Pre: CVE 380 or equivalent.* Nacci

591, 592 Special Problems *(I and II, 1-6 each)* Advanced work under the supervision of a member of the staff and arranged to suit the individual requirement of the student. *(Lec. or Lab. according to nature of problem) Pre: permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

605, 606 Ocean Engineering Seminar *(I and II, 1 each)* Seminar discussions including presentation of papers based on research or literature survey. *(Lec. 1) Attendance is required of all students in graduate residence. A maximum of 1 credit per year is allowed, no more than 2 credits for the entire period.* Staff

610 Engineering Ocean Mechanics *(II, 3)* Applied concepts of ocean flow processes; waves due to gravity, wind, and layered media; large and small scale turbulence; prediction of flow instability; wave forces on structures. *(Lec. 3) Pre: CHE 344, MCE 354 or equivalent.* Spaulding

653, 654 Ocean Engineering System Studies *(I and II, 3 each)* Systems engineering study of an advanced ocean engineering problem. Students will operate as a complete engineering team with specific subsystems designs done with individual faculty members. *(Lec. 3)* Kawalski

661 Analysis of Oceanographic Data Systems *(I, 3)* Design of systems for deep ocean and estuarine data collection and processing. Space-time sampling, multivariate analysis and convergence of moments as applied to ocean data estimation and system design. Current topics in ocean data systems. *(Lec. 3) Pre: ELE 506 or equivalent.* LeBlanc

672 (or ELE 672) Underwater Acoustics II *(II, 3)* Transducers, radiators and receivers, directivity (array structures), equivalent circuits, efficiency; piezoelectricity, magnetostriction, sonar principles, measurements, and calibration. *(Lec. 3)* Stepanishen

673 Advanced Course in Underwater Acoustic Propagation *(I, 3)* Analysis of propagation from a concentrated acoustic source in the ocean by methods such as advanced normal mode theory, numerical integration, and Fast Fourier Transforms. Applications to ocean features such as surface ducts, shadow zones, deep sound channel, etc. *(Lec. 3) Pre: 571 or equivalent.* Stepanishen

674 Nonlinear Acoustics *(II, 3)* Topics in the nonlinear acoustics of fluids. Propagation and interactions of finite-amplitude sound waves. Parametric sonar. Sound generation by turbulence. Cavitation noise. Shock waves. Underwater explosions. Radiation pressure and acoustic streaming. *(Lec. 3) Pre: 571 or permission of instructor.* Staff

675 Processing of Underwater Acoustic Data *(II, 3)* Description of the underwater acoustic environment. Methods of measuring underwater acoustic signals. Data analysis of passive and active signals. Applications of underwater acoustics to oceanographic survey. *(Lec. 3) Pre: ELE 506 or equivalent.* LeBlanc

676 Acoustic Radiation from Underwater Vibrators *(II, 3)* Fundamentals of acoustic radiation from submerged structures. Radiation from planar, cylindrical, and spherical surfaces. In-vacuo and in-fluid vibration of elastic bodies. Acoustic coincidence and fluid loading effects on radiation from elastic

bodies. *Pre: 571 or approval of instructor.* Stepanishen

685 Seminar in Marine Geotechniques See Civil and Environmental Engineering 685.

691, 692 Special Problems *(I and II, 1-6 each)* Advanced work under supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problem) Pre: permission of department.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Oceanography

M.S., Ph.D.

Graduate Faculty

Dean: Professor John A. Knauss, Ph.D., 1959, University of California
Assistant dean for students: Associate Professor Theodore A. Napora, Ph.D., 1964, Yale University
Professor Michael L. Bender, Ph.D., 1970, Columbia University
Professor Robert A. Duce, Ph.D., 1964, Massachusetts Institute of Technology
Professor Harry P. Jeffries, Ph.D., 1959, Rutgers—The State University
Professor James P. Kennett, Ph.D., 1965, D.Sc., 1967, Victoria University of Wellington
Professor Dana R. Kester, Ph.D., 1969, Oregon State University
Professor Roger L. Larson, Ph.D., 1970, University of California, San Diego
Professor Ferren MacIntyre, Ph.D., 1965, Massachusetts Institute of Technology
Professor Robert L. McMaster, Ph.D., 1953, Rutgers—The State University
Professor Nelson Marshall, Ph.D., 1941, University of Florida
Professor Theodore C. Moore, Ph.D., 1968, Scripps Institution of Oceanography
Professor Scott W. Nixon, Ph.D., 1969, University of North Carolina
Professor Candace A. Oviatt, Ph.D., 1967, University of Rhode Island
Professor Michael E. Pilson, Ph.D., 1964, University of California, San Diego
Professor James G. Quinn, Ph.D., 1967, University of Connecticut
Professor Hans T. Rossby, Ph.D., 1966, Massachusetts Institute of Technology
Professor Saul B. Saila, Ph.D., 1952, Cornell University
Professor Akella N. Sastry, Ph.D., 1961, Florida State University
Professor Jean-Guy Schilling, Ph.D., 1966, Massachusetts Institute of Technology
Professor John M. Sieburth, Ph.D., 1954, University of Minnesota
Professor Haraldur Sigurdsson, Ph.D., 1970, Durham University
Professor Theodore J. Smayda, Dr.Philos., 1967, University of Oslo
Professor Melvin E. Stern, Ph.D., 1956, Massachusetts Institute of Technology
Professor Elijah Swift, V, Ph.D., 1967, The Johns Hopkins University
Professor Howard E. Winn, Ph.D., 1955, University of Michigan
Associate Professor Ann G. Durbin, Ph.D., 1976, University of Rhode Island
Associate Professor Edward G. Durbin, Ph.D., 1976, University of Rhode Island
Associate Professor Paul J. Fox, Ph.D., 1972, Columbia University
Associate Professor Paul E. Hargraves, Ph.D., 1968, College of William and Mary
Associate Professor Kenneth A. Rahn, Ph.D., 1971, University of Michigan
Associate Professor D. Randolph Watts, Ph.D., 1973, Cornell University
Associate Professor Mark Wimbush, Ph.D., 1969, Scripps Institution of Oceanography
Assistant Professor Charles E. Barton, Ph.D., 1978, Australian National University
Assistant Professor Peter Cornillon, Ph.D., 1973, Cornell University
Assistant Professor Robert S. Detrick, Jr., Ph.D., 1978, Massachusetts Institute of Technology and Woods Hole Oceanographic Institution
Assistant Professor David Evans, Ph.D., 1975, University of Rhode Island
Assistant Professor Edward P. Laine, Ph.D., 1977, Massachusetts Institute of Technology and Woods Hole Oceanographic Institution
Assistant Professor Karen Wishner, Ph.D., 1979, Scripps Institution of Oceanography

Specializations

Biological, chemical, geological, and physical oceanography.

Master of Science

Admission requirements: GRE (verbal, quantitative and advanced in the applicant's undergraduate major) and bachelor's degree (B average) in some field of the natural sciences or engineering. Applicants are normally admitted for September only. Due to the limited number of students that can be accepted as degree candidates, no application will be considered showing an undergraduate average of less than B unless there is post-baccalaureate work indicating outstanding ability. Applications should be completed by March 15.

Program requirements: thesis, OCG 501, 521, 540, 561, 695; participation in a regular ocean research cruise.

Doctor of Philosophy

Admission requirements: GRE (verbal, quantitative and advanced in the applicant's undergraduate major); master's degree is not required, but bachelor's degree is (B average), in some field of natural sciences or engineering. Applicants are admitted for September only. Due to the limited number of students that can be accepted as degree candidates, no application will be considered showing an undergraduate average of less than B unless there is post-baccalaureate work indicating outstanding ability. Applications should be completed by March 15.

Program requirements: B grade in core courses, OCG 501, 521, 540, 561; six additional course credits in oceanography at the 600 level (excluding problems and research courses and OCG 695); participation in regular ocean research cruise. Although there is no general language requirement, the individual student's major professor may require the demonstration of ability in one or more foreign languages.

Special Financial Aid

There is a limited number of assistantships for master's and doctoral candidates.

General Information

It is anticipated that approximately 25 students will be admitted to the program for the 1983-84 academic year.

OCG Courses
Oceanography

401 General Oceanography *(I and II, 3 each)*
491 Ocean Studies *(I and II, 15 each)*

501 Physical Oceanography *(I, 3)* Basic course covering physical properties of seawater, heat budget, distribution of variables, dynamics, water masses and general circulation, waves and tides. *(Lec. 3) Pre: PHY 213, MTH 141.* Evans

510 Descriptive Physical Oceanography *(II, 3)* Observed distributions of temperature, salinity, currents; methods of deducing deep flow; physical properties of seawater; flow in estuaries; practical work in the analysis of oceanographic data; study of recent literature. *(Lec. 3) Pre: 501.* Watts

521 Chemical Oceanography *(II, 3)* Processes regulating the composition of seawater and the distribution of chemical species. The interaction of marine chemistry with the ocean floor, atmosphere, and marine organism. *(Lec. 2, Lab. 2) Pre: CHM 101, 112 and PHY 213.* Duce

524 Chemistry of the Marine Atmosphere *(II, 3)* Chemistry and physics of marine aerosols, trace gases, and precipitation;

cycles and budgets of atmospheric nitrogen, sulfur, halogen, and carbon compounds; effects of man on the marine atmosphere. *(Lec. 3) Pre: 521 and CHM 432 or permission of instructor. In alternate years, next offered 1986.* Duce

540 Geological Oceanography *(II, 3)* Origin of ocean basins; geomorphology, sediments, volcanism, structure, and tectonics of the deep-sea floor; character and development of continental margins, beaches, and estuaries. *(Lec. 2, Lab. 2) Pre: GEL 103 or ESC 105 and 106, or permission of instructor.* McMaster

544 Seminar in Petrogenesis *(I, 3)* Selected reading and class discussion of topics in igneous petrology and closely related mineral deposits, e.g.: genesis of andesites and basalts, kimberlite-diamond, anorthosite-magnetit-ilmenite, layered intrusive-chromite-platinum deposits, etc. *(Lec. 3) Pre: GEL 530 or equivalent.* Schilling and Sigurdsson

545 Geomagnetism and Paleomagnetism *(I, 3)* Description of past and present magnetic fields of the earth. Principles, methods, results of the application of paleomagnetism to diverse geological, geophysical, and paleontological problems. Lectures and seminars. *Pre: PHY 213 and/or 214 and MTH 142 and/or 243 and/or 244 and some geology, GEL 103 and/or 104, or permission of instructor.* Barton

561 Biological Oceanography *(I, 3)* Nature of life in the sea; adaptations, patterns of distribution and production of plankton, nekton and benthos, their interrelationships and interaction with the environment. *(Lec. 2, Lab. 2) Pre: ZOO 111.* Sieburth

571 Benthic Environment *(I, 3)* Lectures, readings, seminar presentations, discussion, and project work on the physical-chemical properties and total ecology of the benthic marine environment. Includes tidal marshes, rocky intertidal areas, estuarine shoals, coral reefs, and deep-sea benthos. *(Lec. 2, Lab. 2) Pre: permission of instructor.* Nixon

574 Biology of Marine Mammals *(II, 3)* Migration, reproduction, social organization, classification, anatomy, populations, physiology, and communications of cetaceans and pinnipeds. *(Lec. 2, Lab. 2) Pre: permission of instructor. In alternate years, next offered 1985.* Winn

576 (or MIC 576) Marine Microbiology *(I, 4)* The role of bacteria, fungi, apochlorotic algae, flagellates, sarcodines, and ciliates in the cycling of organic matter is discussed in the context of their structure, habitats, trophic modes, ecology, processes, and taxonomy. *(Lec. 3, Lab. 3) Pre: CHM 112 and MIC 201 or 211 or permission of instructor.* Sieburth

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. Staff

605 Dynamical Oceanography *(I, 3)* Simple steady state theories applied to ocean motion. Review of well-known force balances in oceanography, wind-driven circulation, thermohaline circulation, the thermocline, oceanic boundary layers, near shore circulation, diffusion. *(Lec. 3) Pre: 501.* Rossby

607 Geophysical Models *(I, 4)* Selected laboratory experiments modeling the motions of oceans and atmospheres. Comparison of effects of rotation and stratification. Thermal and thermohaline convection, inertial waves and boundary layer phenomena. Emphasis on experimental research techniques and preparation of technical reports. *(Lec. 3, Lab. 3)* Evans

609 Dynamics of Mixing *(II, 3)* Theories of thermocline and the problem of vertical mixing. Relation of mean vertical mixing coefficients to detailed mechanisms of mixing. Internal waves, shear instabilities, lateral spreading and entrainment, thermohaline convection, small scale turbulence. *(Lec. 3) Pre: permission of instructor. In alternate years, next offered 1985.* Evans

610, 611 Geophysical Fluid Dynamics *(I and II, 3 each)* Physics of ocean circulation; surface wave generation, rotating fluids, density currents, quasi-geostrophic motion, laminar viscous flow, turbulence, wind-driven ocean circulation, stratification, convection, thermohaline convection, horizontal convection, and thermoclines. *(Lec. 3) Pre: a prior course in fluid dynamics, and permission of instructor.* Stern

613 Waves *(II, 3)* Generation, propagation and decay of surface waves, internal waves, and Rossby waves in the ocean. *(Lec. 3) Pre: MCE 550 or permission of instructor.* Wimbush

614 Tides *(I, 2)* Generation, propagation, and dissipation of ocean tides. Earth tides. Relation between theory and observation. Tidal analysis. *(Lec. 2) Pre: 501.* Wimbush

620 Chemical Distributions *(II, 3)* Interdisciplinary study of the processes responsible for oceanic chemical distributions with emphasis on conservative properties, biologically active constituents, and radionuclides. Includes projects involving data processing analysis. *(Lec. 3) Pre: 501, 521, 540 and 561 or permission of instructor.* Kester

623 Physical Chemistry of Seawater *(I, 3)* Characterization of dissociation, solubility, and redox equilibria in seawater. Partial molar volumes, conductivity, and diffusion of ions in seawater. Kinetic studies in seawater; effect of temperature, salinity, and pressure on physiochemical properties in seawater. *(Lec. 3) Pre: 521 and CHM 432 or permission of instructor.* Kester

625 Organic Geochemistry *(I, 3)* Chemistry of organic matter in seawater and recent marine sediments. Topics include source, characterization, significance, and fate of dissolved, particulate, and sedimentary organic compounds. *(Lec. 3) Pre: CHM 228 or permission of instructor.* Quinn

628 (630) High Temperature Geochemistry *(I, 3)* Principles and factors governing the distribution of trace elements in volcanic processes. Applications to the study of rock genesis, mantle dynamics, oceanic crust formation and hotspots. *(Lec. 3) Pre: CHM 431 or equivalent, or permission of instructor. Offered in odd calendar years only.* Schilling

629 Isotope Geology *(I, 3)* Principles of natural radioactive growth and decay in closed and open systems. Applications of radiogenic isotopes to the study of the geochemical evolution of the earth's mantle, crust, ocean, and atmosphere. Rock dating. *(Lec. 3) Pre: 628 or permission of instructor. Offered in even calendar years only.* Schilling

631 Seminar in Marine Chemistry *(I and II, 1)* Discussion of problems of current interest in marine chemistry. *(Lec. 1) Pre: 521 or permission of instructor.* Staff

641,642 Geology of Continental Margins I and II *(I and II, 3 each) 641:* Geomorphology, sedimentology, and structure of continental shelves, borderlands, slopes, and rises with consideration of origin and developmental sequence of continental margins. *642:* Characteristics of continental margins compared with those of island arcs, small ocean basins, and geosynclines. Origin and evolutionary relationships considered within the framework of global tectonics. *(Lec. 3) Pre: 540, 641 (for 642), GEL 370 and 550. In alternate years, next offered 1983 for 641, 1984 for 642.* McMaster

645 Petrology of the Oceanic Crust *(II, 3)* Nature and origin of igneous and metamorphic rocks of the oceanic crust of the earth; mineralogy, petrology, and petrogenesis of sea-floor rocks; metamorphism of the ocean crust. *(Lec. 3) Pre: permission of instructor. In alternate years, next offered 1984.* Sigurdsson

646 Deep-Sea Sediments and Processes *(II, 3)* Deep-sea sediments and their relation to oceanic processes such as solution, productivity, and dilution. Sedimentary distributions in time and space as related to tectonic models. Paleoclimatology, and past water mass distributions and conditions. Term paper. *(Lec. 3) Pre: permission of instructor. In alternate years, next offered 1984.* Laine

647, 648 Recent Sedimentary Environments I and II *(I and II, 3 each)* Concentrated study of sedimentary environments with primary emphasis on the relationships between sediment properties of each environment and its environmental conditions. *647:* beach, lagoon, estuary, and bay. *648:* continental shelf, slope and rise. *(Lec. 3) Pre: 501, 540, GEL 550. In alternate years, next offered 1984-85.* McMaster

649 Marine Paleoecology *(I, 3)* Concepts of paleoecology. Review of Pleistocene and Tertiary paleooceanography, paleoclimatology and paleoecology. Criteria and methods used in marine paleoecology, especially those related to foraminifera radiolaria. Biogeography and paleoecology of Cenozoic planktonic faunas. *(Lec. 2, Lab. 1) In alternate years, next offered fall 1984.* Kennett

650 The Micropaleontology of Radiolaria *(II, 3)* Advanced course in the biostratigraphy of radiolaria and their use in paleoecologic studies. Emphasis is placed on the development of skill in radiolarian biostratigraphy of the Mesozoic and Cenozoic. *(Lec. 1, Lab. 4) Pre: permission of instructor.* Staff

651 Cenozoic Marine Stratigraphy *(I, 2)* Extensive reading and class discussion of concepts and methods of biostratigraphy, chronostratigraphy, and lithostratigraphy as applied to the Cenozoic. Stratigraphic nomenclature. Problems and advances in correlation and dating of marine sediments from distinct oceanographic regimes including type European sections. *(Lec. 2) In alternate years, next offered 1983.* Kennett

652 Marine Geophysics *(II, 3)* Survey of basic subdisciplines of marine geophysics including plate tectonics, gravity, magnetics, heat flow reflection, and refraction seismology. Basic theory and methods of data collection and interpretation emphasized. *(Lec. 3) Pre: 540 or permission of instructor.* Detrick

653 Reflection and Refraction Seismology *(I, 3)* Theory and application of marine single-channel, multi-channel, and refraction seismic techniques. Topics include theory of elastic wave propagation, instrumentation, method of data collection, and travel time inversion and interpretation techniques. *(Lec. 3) Pre: 540 and 652 or permission of instructor.* Detrick

654 Seminar in Plate Tectonics *(I, 3)* Extensive reading and seminar discussions of plate kinematics, driving forces, the rheology of the lithosphere, and topics of current research interest. Assumes familiarity with basic concepts of geology, geophysics, and vector analysis. *(Sem. 3) Pre: 540 or permission of instructor.* Larson

660 Ecological Concepts in Marine Research *(I, 3)* Advanced course in ecology, emphasis on marine environment. Ecological theory pertaining to stability and diversity of natural communities and perturbed systems. Field work in Narragansett Bay on zooplankton, benthos, nekton. *(Lec. 1, Lab. 4)* Jeffries

661 (or BOT 661) Phytoplankton Taxonomy *(I, 3)* Classical and modern systems and techniques for the identification, nomenclature, and classification of planktonic algae, with emphasis on marine forms. Phylogeny will be briefly considered. *(Lec. 1, Lab. 4) Pre: permission of instructor. In alternate years, next offered fall 1984.* Hargraves

663 (or BOT 663) Phytoplankton Physiology *(I, 3)* Metabolic processes and methods of their investigation in phytoplankton with primary emphasis on functions pertinent to their ecology. Includes adaptation, uptake of nutrients, excretion, rhythms, pigments, and photosynthesis. *(Lec. 3) Pre: permission of instructor.* Swift

664 (or BOT 664) Phytoplankton Ecology *(II, 3)* Biology and ecology of the pelagic marine microscopic algae with emphasis on their adaptations, physiological ecology, distribution, succession, production, and regional and seasonal dynamics. *(Lec. 3) Pre: permission of instructor.* Smayda

666 Zooplankton *(II, 3)* Biology of marine zooplankton, dealing with morphology, adaptation, distribution, physiology, production, and interrelationships with other members of the marine biota. *(Lec. 1, Lab. 4) Pre: permission of instructor.* Napora

667, 668, 669 (or BOT 667, 668, 669) Advanced Phytoplankton Seminars *(II, 2 each)* Specialized and advanced areas of phytoplankton biology and research, including systematics, physiology, and ecology. *(Sem. 3) Pre: permission of instructor.* Hargraves, Smayda and Swift

670 Fish Population Dynamics *(II, 3)* Methods for estimating vital statistics of fish populations, stock assessment theory and methods, analytical and empirical model development, and fisheries forecasting. *(Lec. 3) Pre: permission of instructor.* Saila

671 Marine Zooplankton Ecology *(II, 3)* Marine zooplankton community structure and function including the relation of spatial and temporal distribution patterns to the oceanic environment, organism interactions, secondary production, feeding and reproduction. Emphasis on open ocean communities. *(Lec. 3) Pre: 561 or permission of instructor.* Wishner

672 Marine Invertebrates and Environment *(I, 3)* Physiological responses of marine invertebrates to seasonal and geographical changes in the environment. Survival, metabolism, reproduction, and larval development of the populations. Mechanisms in adaptation during stages in life cycle examined in relation to changes of certain environmental factors. Physiological variation of populations related to speciation process. Lectures, reading, and discussion. Research project. *(Lec. 3) Pre: 561 and permission of instructor.* Sastry

678 Low Temperature Geochemistry and Isotope Geology *(II, 3)* A study of processes important in determining the chemical and isotopic mass balance of the oceans and the geochemistry of deep sea sediments. *(Lec. 3) Pre: 521.* Bender

679 (or ZOO 679) Animal Communication *(I, 2)* Visual, chemical, and auditory communication in animals, including, receptor systems, feedback, and redundancy. Functional aspects and organization of communication. Discussion of readings. Research problem can be taken under 691 or ZOO 693. *(Lec. 2) Pre: ZOO 467 or equivalent and permission of instructor. In alternate years, next offered 1984.* Winn

681 Marine Pollution *(I, 3)* The intricacies of pollution in the marine environment are explored. Following background reviews, representative case studies are presented. *(Lec. 3) Pre: 501, 521, 540, 561, or permission of instructor.* Marshall

691, 692 Individual Study *(I and II, 1-6 each)* Individual study of assigned topics or special problems, involving literature search and/or original investigation under one or more members of the staff. *(Lec., Lab. TBA)* Staff

693, 694 Special Studies *(I and II, 1-4 each)* Studies of specialized topics in the marine sciences. *(Lec., Lab. TBA)* Staff

695 Seminar in Oceanography *(I and II, 1 each)* Students to give seminar reports on problems and current research in various areas of oceanography. Attendance and registration are required of all students in graduate residence but no more than 2 hours are allowed for a program of study. *(Lec. 1)* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Note: graduate students in oceanography choose from supporting courses in other departments.

Pharmacognosy

M.S., Ph.D. (Pharmaceutical Sciences)

Graduate Faculty

Chairperson: Professor Leonard R. Worthen, Ph.D., 1957, University of Massachusetts
Professor Yuzuru Shimizu, Ph.D., 1962, Hokkaido University
Assistant Professor William L. Lasswell, Ph.D., 1977, University of Mississippi
Adjunct Professor Koji Nakanishi, Ph.D., 1954, Nagoya University
Adjunct Professor Frederick A. Siino, M.S., 1952, University of Massachusetts
Professor Emeritus Heber W. Youngken, Jr., Ph.D., 1942, University of Minnesota

Specializations

Biosynthesis of drug plant constituents, natural product chemistry including the isolation and structural elucidation of materials of potential medicinal interest, screening of natural products for physiologically-active

agents including materials from both land and marine sources.

Master of Science

Admission requirements: GRE, bachelor's degree in pharmacy, chemistry or biology.
Program requirements: thesis, PCG 445, 446, or equivalent; PCG 548, 551, 552.

Doctor of Philosophy (Pharmaceutical Sciences)

Admission requirements: GRE and master's degree in pharmacy, chemistry, or biology, or bachelor's degree in one of these with evidence of superior ability. Qualifying examination is required for candidates accepted without the master's degree.
Program requirements: PCG 551, 552, 633, 634, CHM 521 or equivalent. A candidate entering the Ph.D. program with a bachelor's degree must also meet the M.S. program requirements.

PCG Courses
Pharmacognosy

445, 446 General Pharmacognosy *(I and II, 3 each)*
447 General Pharmacognosy Laboratory *(I and II, 1)*
459 Public Health *(I and II, 3)*

521, 522 Seminar *(I and II, 1 each)* Seminar discussions including presentation of papers on selected topics in pharmacognosy. *(Lec. 1) Students attend seminar each semester while in graduate residence, but a maximum of 1 credit per year is allowed. No more than 3 credits for entire period.* Staff

532 Pharmaceutical Sterile Products *(I, 3)* See Pharmacy 532.

533 Medicinal Plants *(I, 2)* Problems in drug plant chemotaxonomy with field work in the drug plant gardens. Emphasis is placed on certain alkaloid, glycoside, and oil-yielding plants. Weedicides and insecticides as related to measures for control. *(Lec. 1, Lab. 3) Pre: 446 or permission of department.* Staff

536 Antibiotics *(II, 3)* Advanced course on concept of antibiosis, biosynthesis pathways of antibiotic production, testing, chemistry, mechanism of action, medicinal and pharmaceutical uses of antibiotics. Phenomena of sensitivity and resistance; emphasis on entities of importance in pharmaceutical research and production. *(Lec. 3) Pre: permission of department. In alternate years.* Worthen

548 Physical Methods of Identification See Medicinal Chemistry 548.

551, 552 Chemistry of Natural Products *(I and II, 3 each)* Introduction to chemistry of certain groups of natural products especially in relation to their chemotaxonomic position in plant classification. Topics limited to secondary metabolites, e.g., terpenoids, phenolic compounds, aromatic compounds, phytosterols, alkaloids. *(Lec. 3) Pre: CHM 228 and 230. In alternate years, next offered 1983-84.* Shimizu and Lasswell

597, 598 Special Problems *(I and II, 1-3 each)* Special graduate student project assignments in the study of natural drug research under the supervision of faculty. Credits not to exceed total of six. *Pre: permission of department. For graudate students only.* Staff

599 Master's Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

633, 634 Biosynthesis *(I and II, 3 each)* Biogenesis of medicinally active principles of biological origin. Emphasis given to organic acids, polysaccharides, glycosides, steroids, and certain nitrogenous compounds. *(Lec. 3) In alternate years, next offered 1982-83.* Staff

635, 636 Pharmacognosy Techniques *(I and II, 3-4 each)* Physical and chemical factors influencing growth and development of active principles of drug plants. Certain biological analyses of results are performed. *(Lec. 1, Lab. 6-9)* Staff

697, 698 Research in Pharmacognosy *(I and II, 1-3 each)* Literature survey, laboratory work, and a detailed research report on one or more assigned topics. *(Lab. TBA)* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Pharmacology and Toxicology

M.S., Ph.D. (Pharmaceutical Sciences)

Graduate Faculty

Chairperson: Professor John J. DeFeo, Ph.D., 1954, Purdue University
Professor David R. DeFanti, Ph.D., 1962, University of Rhode Island
Associate Professor Alvin K. Swonger, Ph.D., 1971, Dartmouth College
Assistant Professor Clinton O. Chichester, III, Ph.D., 1979, University of Rhode Island
Assistant Professor Robert L. Rodgers, Ph.D. 1977, University of Oklahoma
Adjunct Professor George C. Fuller, Ph.D., 1967, Purdue University
Adjunct Professor Harbans Lal, Ph.D., 1962, Unversity of Chicago
Adjunct Professor Michael D. Turner, Ph.D., 1964, University of Rochester
Adjunct Associate Professor Stuart Fielding, Ph.D., 1968, University of Delaware
Adjunct Associate Professor Stephen R. Kaplan, M.D., 1963, New York University College of Medicine
Adjunct Associate Professor Raymond G. Lundgren, Jr., Ph.D., 1963, University of Missouri
Adjunct Associate Professor Srecko J. Pogacar, M.D., 1953, University of Ljubljana
Adjunct Assistant Professor Daniel L. Dexter, Ph.D., 1972, University of Wisconsin
Adjunct Assistant Professor Cecilia T. Giambalvo, Ph.D., 1975, University of Connecticut
Adjunct Assistant Professor Rupert P. Hammond, Ph.D., 1968, Brown University
Adjunct Assistant Professor Eugene Jackim, Ph.D., 1965, St. John's University
Adjunct Assistant Professor Alexander R. Malcolm, Jr., Ph.D., 1977, University of Rhode Island
Adjunct Assistant Professor Eugene Miller, Ph.D., 1967, University of Chicago
Clinical Lecturer John J. Yashar, M.D., 1950, American University and Teheran University

Specializations

Behavioral, biochemical, cardiovascular, and environmental pharmacology; toxicology; forensic toxicology.

Master of Science

Admission requirements: GRE and bachelor's degree in pharmacy, science, or psychology.
Program requirements: thesis; mathematics through calculus, physical chemistry; one course in statistics; principles of pharmacology; PCL 441, 442, 521, 522. Other courses and research training will be included to complete the program, in accordance with the student's interest and background.

Doctor of Philosophy (Pharmaceutical Sciences)

Admission requirements: GRE and bachelor's or master's degree in pharmacy, science, or psychology.
Program requirments: M.S. degree must be earned prior to Ph.D. if admission is granted without it. Additional courses and special training included according to the requirements of each student's program. Independent research topics will be selected in accordance with the student's interests.

PCL Courses
Pharmacology and Toxicology

436 (or PSY 436) Psychotropic Drugs and Therapy *(II, 3)*
438 (or PSY 438) Psychotropic Drugs and Behavior *(I or II, 3)*
441, 442 General and Clinical Pharmacology *(I and II, 4 each)*

443 General Pharmacology Laboratory *(I and II, 1)*

497, 498 Special Problems *(I and II, 1-3 each)*

521, 522 Seminar *(I and II, 1 each)* Seminar discussions and presentation of papers on selected topics in pharmacology. *(Lec. 1) Students attend seminar each semester while in graduate residence, but a maximum of 1 credit per year is allowed, no more than 3 credits for entire period.* Staff

544 Forensic Toxicology *(I, 3)* Theoretical and practical aspects of poisoning including the isolation and identification of toxic materials from pharmaceuticals, body fluids, and tissues. Isolation and identification of physiological fluids from stains, hairs, and tissue with application to forensic medicine. *(Lec. 2, Lab. 3) Pre: 441, 442 and permission of department. In alternate years, next offered fall 1984.* DeFanti

546 Advanced Toxicology *(II, 3)* Toxic effects of selected drugs and other zenobiotics on physiological and biochemical processes. *(Lec. 3) Pre: 441 and 442 and permission of department. In alternate years, next offered spring 1983.* Staff

550 Operant Analysis of Behavior
See Psychology 550.

562 Psychopharmacology *(II, 3)* Effects of drugs on animml and human behavior and on related biochemical processes. *(Lec. 3) Pre: 441 or equivalent and/or permission of department.* Staff

564 Psychopharmacology Laboratory *(II, 1-3)* Laboratory exercises to demonstrate effects of drugs on animal and human behavior. To earn more than one credit, the student will engage in original work of limited scope. *(Lab. 3-9) Pre: 441 or equivalent and/or permission of department.* Staff

572 Neural Bases of Drug Action *(I, 3)* Review of neuroanatomy, neurochemistry, and neurophysiology as they are related to drug action. *(Lec. 3) Pre: 441 or equivalent and/or permission of department. In alternate years, next offered fall 1983.* Swonger

580 Experimental Animal Techniques
See Electrical Engineering 580.

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

641 Biochemical Pharmacology *(II, 3)* Theory and application of pharmacological studies at the cellular and subcellular levels and their significance to drug action in the intact organism. *(Lec. 3) Pre: 441 and 442 and permission of department. In alternate years, next offered spring 1985.* Chichester

643 Advanced Pharmacology and Techniques *(I, 4)* Mechanism of action of drugs on living tissues, organs, and organisms, with particular emphasis on cellular physiology as a basis of explanation of tissue response. Advanced laboratory techniques as employed for pharmacological testing. *(Lec. 2, Lab. TBA) Pre: 442, and permission of department. In alternate years, next offered fall 1985.* DeFeo

697, 698 Research in Pharmacology *(I and II, 1-5 each)* Literature survey, laboratory work, and a detailed research report on one or more assigned topics. *(Lab. TBA)* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Pharmacy

M.S. Ph.D. (Pharmaceutical Sciences)

Graduate Faculty

Chairperson: Professor Christopher T. Rhodes, Ph.D., 1964, Chelsea College, University of London
Professor George E. Osborne, Ph.D., 1949, Purdue University
Professor Anthony N. Paruta, Ph.D., 1963, Rutgers — The State University
Associate Professor Douglas S. Greene, Ph.D., 1976, University of Connecticut
Associate Professor Joan M. Lausier, Ph.D., 1971, University of Rhode Island
Associate Professor Edward J. Mattea, Pharm.D., 1974, Philadelphia College of Pharmacy and Science
Associate Professor Stanley S. Weber, Pharm.D., 1975, University of Cincinnati
Assistant Professor Bruce K. Birmingham, Ph.D., 1981, University of Rhode Island

Specializations

Pharmaceutics, with emphasis on physical pharmacy, biopharmaceutics, pharmacokinetics, formulation and manufacturing pharmacy, and clinical pharmacy.

Master of Science

Admission requirements: GRE and bachelor's degree in pharmacy or equivalent.
Program requirements: thesis, PHC 521, 522. Courses in physical and industrial pharmacy, pharmacokinetics, and statistics are normally recommended.

Doctor of Philosophy (Pharmaceutical Sciences)

Admission requirements: same as for master's degree. Qualifying examination is required for candidates admitted without the master's degree.
Program requirements: PHC 521, 522.

Pharm. D.

Graduate Faculty

Chairperson: Professor Christopher T. Rhodes, Ph.D., 1964, Chelsea College, University of London
Professor George E. Osborne, Ph.D., 1949, Purdue University
Professor Anthony N. Paruta, Ph.D., 1963, Rutgers — The State University
Associate Professor Douglas S. Greene, Ph.D., 1976, University of Connecticut
Associate Professor Joan M. Lausier, Ph.D., 1971, University of Rhode Island
Associate Professor Edward J. Mattea, Pharm.D., 1974, Philadelphia College of Pharmacy and Science
Associate Professor Stanley S. Weber, Pharm. D., 1975, University of Cincinnati
Assistant Professor Bruce K. Birmingham, Ph.D., 1981, University of Rhode Island
Assistant Professor Olga H. DeTorres, Pharm. D., 1979, University of California, San Francisco
Assistant Professor Roger E. Dionne, Pharm.D., 1980, University of Kentucky
Assistant Professor James E. Dugas, Pharm. D., 1980, State University of New York at Buffalo
Clinical Assistant Professor Frank N. Marr, Jr., Pharm. D., 1976, Duquesne University
Clinical Assistant Professor Norma J. Owens, Pharm. D., 1979, Philadelphia College of Pharmacy and Science

Specializations

The Doctor of Pharmacy program is designed for students desiring excellence in the field of clinical pharmacy. It prepares students for advanced positions in practice, industry, government, clinical research, and academia. The focus of the program is on application of pharmacotherapeutics to individual patients.

Doctor of Pharmacy

Admission requirements: B.S. in pharmacy, GRE, a grade point average of approximately B or above, and three letters of recommendation.
Program requirements: A non-thesis program requiring 61 credit hours with coursework in advanced pharmacotherapeutics, drug-induced diseases, pharmacokinetics, patient communications, and research design and statistics; 18 credit hours of integrated medical science coursework offered in conjunction with Brown University Medical School; and 1800 hours (24 credits) of clinical clerkship/research in affiliate hospitals. Candidates lacking acceptable undergraduate courses in pathology, anatomy, human physiology, biochemistry, immunology, and pharmacokinetics will be required to make up deficiencies. Written

comprehensive examinations and presentation of the research project are required.

PHC Courses
Pharmacy

425 History of Pharmacy *(I and II, 3)*
451, 452 Pharmacotherapeutics I, II *(I and II, 2 each)*
490 Clinical Pharmacy Clerkship *(I and II, 6)*
497, 498 Special Problems *(I and II, 1-3 each)*

501 Drug Information Pertaining to Institutional Pharmacy Practice *(I, 3)* Discussion and evaluation of drug information sources and how to use these sources. Includes the methodology of establishing and maintaining drug information services. *(Lec. 2, Pract. 3)* Staff

521, 522 Seminar *(I and II, 1 each)* Seminar discussions including presentation of papers on selected topics in pharmacy. *(Lec. 1) Students attend seminar each semester while in graduate residence, but a maximum of 1 credit per year is allowed, not more than 3 credits for entire peiod.* Staff

532 (or PCG 532) Pharmaceutical Sterile Products *(II, 3)* Manufacturing principles of sterile dose forms and their clinical applications. Aspects of sterile products such as fluid balance, incompatibilities, microbial contamination, particulate matter are discussed. Aseptic techniques and clinical technique are developed. *(Lec. 2, Lab. 3)* Mattea

535 Pharmacokinetics *(II, 3)* The principles and application of clinical pharmacokinetics for the advanced pharmacy students. Developing, modifying, and evaluating dosage regimens. *(Lec. 3)* Birmingham and Greene

542 Drug-Induced Diseases *(I, 2)* An overview of diseases induced or aggravated by drug therapy. The course is organized using an organ system/disease state approach. *(Lec. 2) Pre: enrollment in Doctor of Pharmacy degree program or 451 and 452.* Weber and Staff

546 Dose Form Technology *(II, 3)* Drug delivery systems, dose form design, physical-chemical properties of drugs, ionic equilibria, kinetics. *(Lec. 3) Pre: 330, 331 or equivalent.* Paruta

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

611 Advanced Pharmacotherapeutics I *(I, 3)* The clinical use of medication in a disease-oriented approach. Correlated basic concepts of pharmacology, pharmacy, pathophysiology, and biochemistry related to treatment of diseases. *(Lec. 3) Pre: enrollment in the Doctor of Pharmacy program.* DeTorres, Dionne, Dugas, Mattea, Owens, Weber

612 Advanced Pharmacotherapeutics II *(II, 3)* The clinical use of medication in a disease-oriented approach. Correlates basic concepts of pharmacology, pharmacy, pathophysiology, and biochemistry related to treatment of diseases. *(Lec. 3) Pre: enrollment in Doctor of Pharmacy degree program.* DeTorres, Dionne, Dugas, Mattea, Owens, Weber

621, 622 Manufacturing Pharmacy *(I and II, 2-5 each)* Theory and practice in the manufacture of pharmaceuticals and the principles of operation of the equipment used for their production. *(Lec. 2, Lab. 0-9)* Paruta

631 Advanced Physical Pharmacy *(I, 3-5)* Application of physical-chemical principles to problems in pharmaceutical research, with emphasis on methods by which properties of new medicinal and pharmaceutical agents are determined. *(Lec. 3, Lab. 3-6) Pre: CHM 432 or permission of department.* Paruta

632 Advanced Physical Pharmacy *(II, 2-4)* Application of physical-chemical principles to problems in pharmaceutical research, with emphasis on methods by which properties of new medicinal and pharmaceutical agents are determined. *(Lec. 2, Lab. 0-6) Pre: 631.* Paruta

662 Biopharmaceutics *(I, 3)* Pharmacokinetic principles as applied to absorption, metabolism, and excretion of drugs from finished dosage forms. Includes oral, parenteral, topical, and sustained release forms. *(Lec. 3) Pre: 384. In alternate years, next offered 1983-84.* Rhodes

663 Pharmacokinetics *(II, 3)* Application of pharmacokinetic principles to the disposition of drugs in the body. Includes effect of disease states on drug absorption, distribution, and elimination. *(Lec. 3) Pre: MTH 141, PHC 338, PCL 422, PHC 662 or equivalent, departmental permission and graduate standing.* Greene

671, 672 Integrated Medical Sciences I, II *(I and II, 6-12)* The pathophysiology of the hematologic, gastrointestinal, respiratory, endocrine, renal, reproductive, supporting structure and cardiovascular systems; biomedical topics in nutrition; and the biomedical basis of infectious disease. Offered by the Brown University Program in Medicine as part of the Integrated Medical Science Sequence. *(Lec. 18) Maximum total of 18 credits. Pre: enrollment in Doctor of Pharmacy degree program.* Staff

681 Clinical Pharmacy Seminar I *(I, 1)* Presentation made by students on appropriate advanced clinical pharmacy topics. *(Sem. 2) Pre: enrollment in the Doctor of Pharmacy degree program.* Staff

682 Clinical Pharmacy Seminar II *(II, 1)* Presentation made by students in appropriate advanced clinical topics. *(Sem. 2) Pre: enrollment in the Doctor of Pharmacy degree program.* Staff

690, 691, 692 Clerkship Research I, II, III *(SS, I, and II, 8 each)* Application and development of advanced clinical skills and knowledge, communication techniques, and clinical research. Skills refined by functioning as a clinical pharmacist in a clinical practice site under the supervision of a faculty member *(Lab. 40) Pre: enrollment in the Doctor of Pharmacy degree program. May be repeated for up to 24 credits.* Staff

697, 698 Research in Pharmacy *(I and II, 1-3 each)* Literature survey, laboratory work, and a detailed research report on one or more assigned topics in pharmacy. *(Lab. TBA)* Staff

699 Doctoral Dissertation Reseach *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Pharmacy Administration
M.S.

Graduate Faculty

Professor Norman A. Campbell, Ph.D., 1972, University of Wisconsin
Associate Professor Albert H. Taubman, Ph.D., 1971, University of Pittsburgh
Adjunct Assistant Professor Charles Hachadorian, Jr., M.P.A., 1969, University of Rhode Island
Adjunct Professor Donald L. Ford, B.A., 1955, University of Louisville
Adjunct Professor Armand P. Leco, B.S. 1947, Providence College

Specializations

Development and utilization of pharmacy resources in health care systems involving the organization, financing, and delivery of health care services and materials and the legal and socioeconomic constraints.

Master of Science

Admission requirements: GRE or MAT and first professional degree in pharmacy.
Program requirements: thesis; PAD 599, 621, 622, 651, 652, EST 408 or equivalents.

Special Financial Aid

Fellowships from the American Foundation for Pharmaceutical Education.

PAD Courses
Pharmacy Administration

405 Personnel Administration *(I, 3)*
406 Pharmacy Retailing *(II, 4)*
453 Drug Marketing Principles *(II, 2)*
480 Prepaid Drug Plans *(I, 3)*

497, 498 Special Problems *(I and II, 1-3 each)*

530 Behavioral Skills in Clinical Pharmacy *(SS, 3)* Communication skills, behavioral aspects of illness, and the social and ethical considerations of clinical pharmacy. *(Lec. 3) Pre: enrollment in Doctor of Pharmacy degree program, or permission of department.* Staff

570 Case Studies in Pharmacy Law *(II, 3)* Case studies and a detailed analysis of the FDC, Controlled Substances Act, health insurance laws. *(Lec. 3) Pre: 351. In alternate years.* Campbell

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. Staff

621, 622 Seminar *(I and II, 1 each)* Seminar discussions and presentation of papers on selected topics in pharmacy administration. *(Lec. 1) Students attend seminar each semester while in graduate residence, but a maximum of 1 credit per year is allowed, no more than 3 credits for entire program.* Staff

625, 626 Hospital Pharmacy Administration *(I and II, 2 each)* Hospital organizations, including intra- and inter-department relationships, the medical and service staff problems, the administrator, personnel management, pharmaceutical service with relation to patient care, medical and pharmaceutical research. *(Lec. 3) In alternate years.* Staff

651, 652 Health Care Systems I and II *(I and II, 3 each)* Arrangements for utilizing pharmaceutical resources in public and private systems of health care in the U.S. and other countries. Variations in quality and distribution of care among socioeconomic groups. *(Lec. 3) Pre: 480 and EST 408 or 409, or equivalent.* Campbell

680 Legal Environmental in Health Administration *(I, 3)* Application of specialized statutory and regulatory provisions in federal and state law to the delivery of health care. *(Lec. 3) Pre: graduate standing.* Campbell

697, 698 Research in Pharmacy Administration *(I and II, 1-3 each)* Literature survey, laboratory work, and a detailed research report on one or more assigned topics in pharmacy administration. *(Lab. TBA)* Staff

Philosophy

M.A.

Graduate Faculty

Chairperson: Professor Fritz Wenisch, Ph.D., 1968, University of Salzburg
Professor David H. Freeman, Ph.D., 1958, University of Pennsylvania
Professor Yong Choon Kim, Ph.D., 1969, Temple University
Professor John F. Peterson, Jr., Ph.D., 1965, Indiana University
Professor Stephen D. Schwarz, Ph.D., 1966, Harvard University
Professor William Young, B.Litt., 1958, University of Oxford
Associate Professor John W. Hanke, Ph.D., 1967, Indiana University
Associate Professor Galen A. Johnson, Ph.D., 1977, Boston University
Associate Professor James G. Kowalski, Ph.D., 1975, University of Notre Dame
Associate Professor Donald J. Zeyl, Ph.D., 1972, Harvard University

Specializations

Programs of study are offered in the following general areas: logic and philosophy of science, axiology and history of philosophy.

Master of Arts

Admission requirements: GRE, 18 credit hours in basic philosophy courses (students whose undergraduate preparation did not include at least 18 credit hours in basic philosophy courses will be required to take these in addition to the graduate program requirements).

Program requirements: thesis option: 24 credit hours in coursework, 6 credit hours in master's thesis research. Non-thesis option: 30 credit hours in coursework, comprehensive examination. Students in both options will normally include 6 credits of coursework in disciplines other than philosophy. Proficiency in a foreign language will be required if the student's program committee considers it essential for the topic of the thesis or of the substantial paper involving significant independent research to be written by a student choosing the non-thesis option.

PHL Courses
Philosophy

401, 402 Special Problems *(I and II, 3 each)*
414 Advanced Studies in Ethics *(I or II, 3)*
440 Philosophy of Language *(I or II, 3)*
451 Symbolic Logic *(I or II, 3)*
453 Philosophy of Psychology *(II, 3)*

502, 503, 504, 505 Tutorial in Philosophy *(I and II, 3 each)* Discussion by the staff and advanced students of research problems in philosophy. Presentation and criticism of original papers. *(Lec. 3) Pre: graduate standing or permission of instructor.* Staff

513 General Axiology *(I or II, 3)* Intensive historical and systematic study of issues such as nature and kinds of values, their ontological status, their relation to culture, their relation to emotions, relation of axiology to other disciplines. *(Lec. 3) Pre: graduate standing or permission of instructor.* Wenisch or Staff

530 Philosophy of Plato *(I or II, 3)* Selected dialogues from the later period. Particular attention will be given to the areas of metaphysics, epistemology, cosmology, and ethics. *(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years.* Zeyl

531 Philosophy of Aristotle *(I or II, 3)* Selected texts with emphasis on the major concepts of Aristotle's metaphysics, theory of knowledge, and ethics. *(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years.* Zeyl

542 Advanced Studies in Patristic and Scholastic Philosophy *(I or II, 3)* Intensive studies of one or more thinkers belonging to the patristic or scholastic tradition. The specific subject may change from year to year. *(Lec. 3) Pre: graduate standing or permission of instructor.* Young or Peterson

551 Philosophical Logic *(I or II, 3)* Intensive consideration of such issues as the nature, structure and function of propositions, predication, analysis of the "is" relation. Relation between proposition and facts. Nature of logic and criterion of the logical, relation of logic to language, psychology and ontology. *(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years.* Young

555 Philosophy of the Arts and of Literature *(I or II, 3)* An intensive study of one or more thinkers concerned with philosophical problems arising from our experience of the arts and of literature. The phenomenological tradition will be stressed. *(Lec. 3) Pre: graduate standing or permission of instructor.* Hanke

562 Advanced Studies in Empiricism and Rationalism *(I or II, 3)* Intensive study of one or more thinkers belonging to the empiricist or rationalist tradition. The specific subject may change from year to year. *(Lec. 3) Pre: graduate standing or permission of instructor.* Young or Staff

570 Philosophy of Immanuel Kant *(I or II, 3)* Intensive analysis of major texts. Special attention will be given to *The Critique of Pure Reason. (Lec. 3) Pre: graduate standing or permission of instructor. In alternate years.* Peterson or Staff

580 Nineteenth-Century Philosophy *(I or II, 3)* Intensive analysis of the work of a major philosopher or philosophical movement. Attention will be given to such major figures as Hegel, Kierkegaard, C.S. Peirce, or James. The specific subject changes from year to year. *(Lec. 3) Pre: graduate standing or permission of instructor. In alternate years.* Young or Staff

582 Advanced Studies in Contemporary Philosophy *(I or II, 3)* Intensive studies of one or more thinkers of philosophical movements of the twentieth century. The specific subject may change from year to year. *(Lec. 3) Pre: graduate standing or permission of instructor.* Young or Staff

599 Masters Thesis Research *(I and II)* Number or credits is determined each semester in consultation with the major professor or program committee.

966 Student Teaching in Philosophy *(I or II, 3)* Discussion of purpose of teaching philosophy in various types of institutions, of alternative syllabi for various philosophy courses, actual classroom teaching under supervision, critical evaluation of teaching performance. *Restricted to graduate students in philosophy. For non-program credit only.* Staff

Physical Education

M.S.

Graduate Faculty

Chairperson: Associate Professor J. Richard Polidoro, D.P.E., 1969, Springfield College
Professor M. Dorothy Massey, Ed.D., 1957, Boston University
Professor Raymond A. Nedwidek, Ed.D., 1965, University of Pittsburgh
Professor Robert J. Sonstroem, Ph.D., 1968, University of Minnesota
Associate Professor Lorraine C. Bloomquist, Ed.D., 1974, Boston University
Associate Professor Greta L. Cohen, M.Ed., 1966, Temple University
Associate Professor Jeannette E. Crooker, M.S., 1959, University of Rhode Island
Associate Professor Frank DelSanto, Ed.D., 1976, Boston University
Associate Professor Barbara Mandell, M.A. 1959, Columbia University
Associate Professor Thomas Manfredi, Ph.D., 1976, University of Massachusetts
Associate Professor Leo E. O'Donnell Ed.D., 1970, Temple University
Associate Professor Diane Seleen, Ed.D., 1981, Boston University
Associate Professor Arthur L. Sherman, Ed.D., 1976, Boston University

Specializations

Physical education, exercise science, health education, recreation education, adapted physical education, gerontology, and psychology of sport.

Master of Science

Admission requirements: MAT or GRE with B.S. degree in physical education, health and physical education, or health education. In exceptional cases, a candidate without a physical education major or related area but with a strong emphasis in physical education, is accepted.

Program requirements: thesis (30 credit hours) and PED 510, 530, 599; three credits from PED 578 or 581, and three credits from PED 561, 562, or 585; for non-thesis option (33 credit hours) PED 510, 530, 591; three credits from PED 578 or 581, and three credits from PED 561, 562, or 585 and written master's comprehensive.

PED Courses
Physical Education

410 Corrective and Adapted Physical Education *(I, 3)*
430 Adapted Aquatics *(I and II, 3)*
466 Modern Dance Choreography *(I and II, 3)*
484 (or HLT 484 or RCR 484) Supervised Field Work *(I and II, 6 or 12)*
486 (or HLT 486 or RCR 486) Field Experience Seminar *(I and II, 3)*

510 Current Issues in Physical Education, Health and Recreation *(I and II, 3)* Designed to develop student awareness of contemporary situations that are of concern to the above professions. Extensive review of contemporary literature. Critical analysis of selected issues, their components, and effects. *(Lec. 3) Pre: permission of instructor.* Staff

520 Curriculum Construction in Physical Education *(I or II, 3)* Analysis of criteria and procedures for curriculum construction in physical education. Standards for the evaluation and revision of elementary and secondary school physical education courses. *(Lec. 3) Pre: permission of instructor.* Staff

530 Research Methods and Design in Health and Physical Education *(I or II, 3)* Introduction to methodology in experimental, laboratory, curriculum, action, and historical research. *(Lec. 3) Pre: competence in basic statistics and permission of instructor.* Staff

531 Advanced Experimental Techniques in Physical Education *(II, 3)* In-depth analysis of research studies in the field. Advanced research technique studied and applied to problems in physical education. *(Lec. 3) Pre: 530 or permission of instructor.* Sonstroem

540 Principles of Recreation Leadership *(I or II, 3)* Modern concepts of responsibilities involved in program planning in schools and community agencies. Leadership of committees and board relations as well as practical program promotional techniques. *(Lec. 3) Pre: permission of instructor.* Staff

543 Outdoor Recreation and Education *(I or II, 3)* Investigation of the present scope and significance of the present-day outdoor recreation and education movements and an examination of current ideas and practices. *(Lec. 3) Pre: permission of instructor.* Staff

550 Administration of Physical Education *(I or II, 3)* Problems and procedures for administering a physical education program studied from the viewpoint of the physical education administrator, the school administrator, and the faculty. Emphasis is placed upon the study of administrative cases. *(Lec. 3) Pre: 380 or permission of instructor.* Staff

552 Supervision of Physical Education and Health Instruction *(I or II, 3)* Principles, techniques, and procedures involved in effective supervision of physical education and health instruction, with emphasis on leadership role of the supervisor in the improvement of instruction. *Pre: graduate standing or permission of instructor. (Lec. 3)* Nedwidek

560 (or HLT 560) Seminar in Health, Physical Education and Recreation *(I or II, 3)* Selected topics within the three areas, depending on availablility of specialized instruction including visiting professorship. *(Lec. 3) Pre: permission of instructor.* Staff

561 Science in Sport and Exercise *(I or II, 3)* Special lectures, readings, library research on topics of current research interest relating to science in sport and exercise. *(Lec. 3) Pre: graduate standing or permission of instructor.* Staff

562 Advanced Exercise Physiology *(I or II, 3)* Advanced study of the physiological factors limiting physical performance and work capacity, with emphasis on the effects of physical conditioning on health and fitness. *(Lec. 3) Pre: ZOO 343 or permission of instructor.* Staff

563 Fitness Programs for the Middle-Aged and Elderly *(I or II, 3)* Provides the professional physical educator with an in-depth knowledge of scientific principles applicable to the administration of adult physical fitness programs. Client characteristics, screening, program supervision, liability, recruitment and adherence. *(Lec. 3) Pre: graduate standing or permission of instructor.* Sonstroem

564 Physiology of Aging *(I or II, 3)* Library searches, reports and discussion of topics of current research on the physiology of aging. Subject matter adapted to meet interests of staff and students. *(Lec. 3) Pre: ZOO 242 or permission of instructor.* Sonstroem

570 (or HLT 570) Major Health Problems and Curriculum Planning in Health Education *(I or II, 3)* Major health problems related to personal and community health with emphasis on health education, curriculum planning, and evaluation. *(Lec. 3) Pre: permission of instructor.* Staff

575 Perceptual-Motor Education *(I or II, 3)* Role of motor activity in enhancing perceptual development. How the physical educator can become involved with other school personnel in the implementation and continuing development of perceptual-motor programs. For teachers in elementary schools and in special education who wish to incorporate motor activities into their programs. *(Lec. 3) Pre: PSY 113, 232 and permission of instructor.* Staff

578 Sport in American Culture *(I or II, 3)* A survey of contemporary themes relating to the study of human behavior in sports contexts in

American culture. *(Lec. 3) Pre: graduate standing or permission of instructor.* Staff

580 Physical Education: Mentally Retarded and Learning Disabled *(I or II, 3)* Contributions of physical education to the growth and development of the mentally retarded and learning disabled. Theoretical and practical aspects of programs to best serve their individual needs. *(Lec. 3) Pre: permission of instructor.* Bloomquist

581 Psychological Aspects of Physical Activity *(II, 3)* Scientific principles and research from psychology related to physical activity. Educational program situations amenable to research and application of psychological principles are isolated. Recommendations for improvements in physical education methodology. *(Lec. 3) Pre: PSY 113, 232 and permission of instructor.* Staff

585 Adapted Physical Activities for Special Populations *(I, 3)* Characteristics and needs for special populations: retarded, emotionally disturbed, learning disabled, sensory impaired, and obese. Adapted activites based on individual needs. Effects of federal legislation on programs discussed. *(Lec. 3) Pre: permission of instructor.* Bloomquist

591 (or HLT 591) Special Problems *(I or II, 3)* Written paper reporting an in-depth investigation of a pertinent problem in the field, including a review of relevant literature, analysis, and solution of the problem based on scientific methodology, with recommendations for improved practices. *Limited to and required of all master's degree candidates in physical education who elect the non-thesis option.* Staff

595 (or HLT 595) Independent Study *(I or II, 3)* Development of an approved project supervised by a member of the Graduate Faculty. *Pre: permission of department and instructor/staff. May not be substituted for 591 or 599.* Staff

599 (or HLT 599) Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee. Staff

HLT Courses
Health

484 (or PED 484) Supervised Field Work *(I and II, 6 or 12)*
486 (or PED 486) Field Experience Seminar *(I and II, 3)*

560 Seminar in Health, Physical Education, and Recreation
See Physical Education 560.

570 Major Health Problems and Curriculum Planning in Health Education
See Physical Education 570.

591 Special Problems
See Physical Education 591.

595 Independent Study
See Physical Education 595.

599 Masters Thesis Research
See Physical Education 599.

RCR Courses
Recreation

416 Physical Aging and Leisure Skill *(II, 3)*
484 (or PED 484) Supervised Field Work *(I and II, 6 or 12)*
485 Planning and Supervision of Recreation Facilities *(I, 3)*
486 Field Experience Seminar *(I and II, 3)*

Physics

M.S., Ph.D.

Graduate Faculty

Chairperson: Professor Stanley J. Pickart, Ph.D., 1959, University of Maryland
Professor Jill C. Bonner, Ph.D., 1968, King's College, University of London
Professor J. Scott Desjardins, Ph.D., 1959, Columbia University
Professor Frank T. Dietz, Ph.D., 1951, Pennsylvania State University
Professor Donald F. Kirwan, Ph.D., 1969, University of Missouri
Professor Stephen V. Letcher, Ph.D., 1964, Brown University
Professor Surendra S. Malik, Ph.D., 1960, Agra University
Professor Jan A. Northby, Ph.D., 1966, University of Minnesota
Professor Anthony C. Nunes, Ph.D., 1969, Massachusetts Institute of Technology
Associate Professor Frank W. Cuomo, M.S., 1961, University of Rhode Island
Associate Professor Kenneth L. Hartt, Ph.D., 1963, University of Nebraska
Associate Professor Charles Kaufman, Ph.D., 1963, Pennsylvania State University
Associate Professor William S. Penhallow, M.S., 1957, University of Maine
Assistant Professor Leonard M. Kahn, Ph.D., 1976, Brown University

Specializations

Acoustics and optics: underwater acoustics; acoustic imaging; ultrasonics; acousto-optical transducers; fiber optics.

Astronomy: astrometry; differential photometry.

Condensed matter theory: low dimensional physics; statistical mechanics; magnetism; surface magnetism; chemisorption; superconductivity; alloys; hydrogen in metals.

Interdisciplinary physics: energy-related physics; climate modeling; computational physics; biophysics.

Liquid state: liquid crystals; liquid helium; ferrofluids, turbulence; superfluids.

Low temperature physics: ionic mobilities; finite droplet effects; magnetic susceptibility; specific heats; magnetic cooling.

Neutron physics: ultra-cold neutrons; neutron capture spectroscopy; neutron optics.

Neutron scattering: small-angle scattering; solution scattering; surfaces and fine particles; crystal structure; amorphous magnets; inelastic scattering; phonons and spin waves.

Nuclear theory: inverse scattering studies; few-nucleon studies; hypernuclei; weak interactions.

Master of Science

Admission requirements: GRE with advanced test; bachelor's degree with major in physics preferred.

Program requirements: PHY 510, 520, 530, 570 and either PHY 560 or 565, plus successful completion of a written comprehensive examination, are required of all students. For the non-thesis option, the student shall complete 36 course credits, with at least one course requiring a substantial paper involving significant independent study, and shall pass a final oral exam. For either option, no more than 6 credits in the program may be below the 500 level.

Doctor of Philosophy

Admission requirements: GRE with advanced test; bachelor's degree with major in physics preferred. Master's degree is not required.

Program requirements: PHY 510, 511, 520, 525, 530, 531, 570, 571, 650, 660 and either 560 or 565 and 651 or 661. There is no formal departmental language requirement, although the candidate's committee may require demonstration of language proficiency. Successful completion of a qualifying examination is required of all students.

PHY Courses
Physics

401, 402 Seminar in Physics *(I and II, 1 each)*
406 (or MCE 406) Atmospheric Physics I *(I, 3)*
407 (or MCE 407) Atmospheric Physics II *(II, 3)*
420 Introduction to Thermodynamics and Statistical Mechanics *(I, 3)*
425 Acoustics *(I, 3)*
451 Atomic and Nuclear Physics *(I, 3)*
452 Nuclear Physics *(II, 3)*
455 Introduction to Solid State Physics *(II, 3)*
483, 484 (or AST 484) Laboratory and Research Problems in Physics *(I and II, 3 each)*
491, 492 (or AST 491, 492) Special Problems *(I and II, 1-6 each)*

510, 511 Mathematical Methods of Physics *(I and II, 3 each)* Definition of a vector, vector algebra and calculus, scalar and vector fields, linear vector operators, coordinate transformations, vector operations in curvilinear coordinates, dyadics, tensors, simple applications of the theory of finite groups. Partial differential equations of physics and their solutions, diffusion equation, wave equation, Schrodinger equation, Klein-Gordon equation, elements of the theory of probability. *(Lec. 3) Pre: permission of department.* Staff

520 Classical Dynamical Theory I *(I, 3)* Lagrange's equations, holonomic and nonholonomic constraints, applications to dynamical systems, non-inertial systems, alternate formulations of mechanics, theory of small vibrations, variational principles, Hamiltonian formulation of dynamics, canonical transformations. *(Lec. 3) Pre: 510 or concurrent registration in 510.* Staff

525 Statistical Physics *(I, 3)* Probability distributions, information theory, ensembles in classical and quantum physics, partition functions, fluctuation and noise, statistics of identical particles. Applications to solids, liquids, and gases. *(Lec. 3) Pre: 420 or equivalent.* Staff

530 Electromagnetic Theory I *(II, 3)* Coulomb's law, Gauss' law, scalar potential, boundary value problems, multipole expansion, dielectrics, magnetic field due to stationary currents, scalar and vector potential, magnetic materials, Faraday's law, Lorentz force, conservation laws. Maxwell's equations. *(Lec. 3) Pre: 510.* Staff

531 Electromagnetic Theory II *(I, 3)* Scalar and vector wave equations and their solutions, retarded and advanced potentials. Lienard-Wiechert potentials, radiation from an arbitrarily moving charge, multipole radiation, wave guides, cavity resonators, plasma oscillations, theory of relativity. *(Lec. 3) Pre: 511, 530.* Staff

550 Physical Acoustics *(I, 3)* Physical properties of gases, liquids, and solids as revealed by the propagation of acoustic waves. Ultrasonic generation and measurement techniques, irreversible thermodynamics, mechanisms for absorption, and dispersion of acoustic waves. *(Lec. 3) Pre: permission of department.* Letcher

560 Introduction to Neutron Physics *(I, 3)* Introduction to the field of neutron interaction with matter. Properties of the neutron, instrumentation, scattering theory. Applications to diffraction from magnetic and non-magnetic systems, solution scattering, and inelastic scattering. *(Lec. 2, Lab. 2) Pre: permission of instructor.* Nunes and Malik

565 Introduction to Liquid State Physics *(II, 3)* Equations governing macroscopic flow, description of turbulence. Macroscopic correlations (temperature, velocity, etc.), microscopic correlations and intermolecular forces. Liquid-liquid phase transitions, and quantum fluids. Laboratory work will be required as appropriate. *(Lec. 2, Lab. 2) Pre: permission of instructor.* Staff

570 Quantum Mechanics I *(II, 3)* Wave packets, Schrodinger equation, one-dimensional problems, hydrogen atom, harmonic oscillator, WKB approximation, operator formalism and matrix mechanics, angular momentum, perturbation theory, scattering and partial wave analysis, semiclassical treatment of the radiation field. *(Lec. 3) Pre: permission of department.* Staff

571 Quantum Mechanics II *(I, 3)* Dirac equation, spin orbit energy, theory of positrons, Feynman diagrams, Compton scattering, pair production and bremsstrahlung. Second quantization and application to selected topics. *(Lec. 3) Pre: 570.* Staff

585 Acoustic Measurements *(II, 1-2)* Techniques for the measurement and analysis of sound in fluids and solids. *(Lab. 3-6) Pre: permission of department.* Staff

590, 591 Special Problems *(I and II, 1-6 each)* Advanced work under the supervision of a member of the staff and arranged to suit the individual requirements of the student. *(Lec. or Lab. according to nature of problem) Credits not to exceed 12. Pre: permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

620 Quantum Statistical Mechanics *(II, 3)* Advanced statistical mechanics, density matrices, Ising and Heinsenberg models. Application to theory of liquids, critical phenomena, percolation theory, and other areas of current research interest. *(Lec. 3) Pre: 525 or permission of instructor. In alternate years.* Staff

630 Electromagnetic Theory III *(I, 3)* After developing the covariant formulation of electrodynamics, selected topics of current interest in electromagnetic theory such as accelerator design, etc., will be discussed. *(Lec. 3) Pre: 531. In alternate years.* Staff

650, 651 Solid State Physics *(I and II, 3 each)* Quantum theory of electrons, phonons, and other elementary excitations, Hartree-Fock approximation, many body problem, super conductivity, band theory, and Fermi surface. *(Lec. 3) Pre: 455 or equivalent and 570. In alternate years.* Staff

660, 661 Nuclear Physics *(I and II, 3 each)* General properties of the nucleus. Two body problem at low, intermediate, and high energy. Three and four body problems, nuclear forces, special models, nuclear spectroscopy and reactions, decay of nuclei, many body problem, structure of nucleons. *(Lec. 3) Pre: 511, 571. In alternate years.* Staff

670, 671 Advanced Quantum Theory *(I and II, 3 each)* Relativistic quantum field theory, free and interacting fields, the S-matrix and the perturbation expansion, quantum electrodynamics, dispersion relations, symmetry operations, and invariance properties. *(Lec. 3) Pre: 571. In alternate years.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

AST Courses
Astronomy

406 (or PHY 406) Atmospheric Physics I *(I, 3)*
407 (or PHY 407) Atmospheric Physics II *(II, 3)*
408 Introduction to Astrophysics *(II, 3)*
484 (or PHY 484) Laboratory and Research Problems in Physics *(I and II, 3)*
491, 492 (or PHY 491, 492) Special Problems *(I and II, 1-6 each)*

Plant and Soil Science

M.S.

Graduate Faculty

Chairperson: Professor John J. McGuire, Ph.D., 1968, University of Rhode Island
Professor James H. Brown, Jr., D.F., 1965, Duke University
Professor Robinson J. Hindle, Ph.D., 1964, University of Rhode Island
Professor Richard J. Hull, Ph.D., 1964, University of California
Professor Walter E. Larmie, M.S., 1954, University of Rhode Island
Professor Conrad R. Skogley, Ph.D., 1957, Rutgers — The State University
Professor Robert C. Wakefield, Ph.D., 1954, Rutgers — The State University
Associate Professor Dale T. Duff, Ph.D., 1967, Michigan State University
Associate Professor Francis C. Golet, Ph.D., 1973, University of Massachusetts
Associate Professor Robert E. Gough, Ph.D., 1977, University of Rhode Island
Associate Professor Walter P. Gould, Ph.D., 1966, Syracuse University
Associate Professor John A. Jagschitz, M.S., 1954, Cornell University
Associate Professor William R. Krul, Ph.D., 1967, Purdue University
Associate Professor Richard J. Shaw, Ph.D., 1966, University of Missouri
Assistant Professor Thomas P. Husband, Ph.D., 1977, Michigan State University
Assistant Professor W. Michael Sullivan, Ph.D., 1981, University of Nebraska

Specializations

Turfgrasses, woody ornamentals, and agricultural crops. Program emphasis may be developed in plant-soil nutrient relations, plant propagation including tissue culture, stress physiology, weed science, and the ecology of crop production. Additional areas include landscape ecology, floriculture, wetland and forest ecology, fruit science, plant improvement and forage management. Specializations in soil science are also available in the resource chemistry program.

Master of Science

Admission requirements: B.A. or B.S. degree with undergraduate courses in botany, agronomy, or horticulture, chemistry, mathematics, physics, and soils passed with grades of A or B. Deficiencies in these areas must be corrected without graduate program credit. GRE score (verbal and quantitative) totaling approximately 1000 or higher is expected. An area of interest corresponding to a field of program emphasis must be indicated. Applicants are encouraged to contact a faculty member in their area of interest who would be willing to serve as their major professor. Initial contact may be made with the chairperson of the Plant and Soil Science Graduate Affairs Committee which reviews all graduate applications. No student will be accepted unless a tentative program adviser has been identified.

Program requirements: Thesis and supporting study in botany, chemistry, geology, plant and soil science, and statistics as determined by the student and program committee. Three departmental seminars which include a final thesis seminar.

General Information

Work beyond the M.S. degree in the physiology or ecology of turfgrasses and woody ornamentals, plant propagation or development and environmental physiology may be developed in cooperation with departments offering a Ph.D. degree in biological sciences.

PLS Courses
Plant Science

401, 402 (or SLS 401, 402) Plant and Soil Science Seminar *(I and II, 1 each)*
405 Propagation of Plant Materials *(II, 3)*
413 Plant Cell and Tissue Culture *(I, 3)*
420 Crop Ecology *(I, 3)*
435 Greenhouse Crop Production and Postharvest Handling *(II, 3)*
436 Floriculture and Greenhouse Crop Production *(I, 3)*
442 Professional Turfgrass Management *(II, 3)*
444 Environmental Aspects of Landscape Design *(II, 3)*
446 Landscape Construction *(II, 3)*
454 Identification of Basic Ornamental Plants *(II, 3)*
461 Weed Science *(II, 3)*
472 Plant Improvement *(II, 3)*
475 Plant Nutrition and Soil Fertility *(II, 4)*
478 (or SLS 478) Plant Biochemistry *(II, 3)*
491, 492 Special Projects and Independent Study *(I and II, 1-3 each)*

501 to 504 (or SLS 501 to 504) Graduate Seminar in Plant and Soil Science *(I and II, 1 each)* Presentation of technical reports and discussion of current research papers in soil science, landscape ecology, growth and development of economic crops, and production and management of economic crops. *(Lec. 1) Pre: permission of instructor.*

512 Plant Growth and Development *(II, 4)* Environmental, chemical, and genetic regulation of plant development, from seed formation to senescence. *(Lec. 3, Lab. 3) Pre: BOT 445. In alternate years, next offered 1983-84.* Krul

513 Laboratory Plant Tissue Culture *(II, 1)* Techniques for initiation and continuous culture of plant cells; protoplast isolation, fusion, and selection; micropropagation, somatic embryogenesis, and production of haploid plants via pollen and another culture. *(Lab. 3) Pre: BOT 245, concurrent registration in 413, and permission of instructor.* Krul

576 Physiology of Plant Productivity *(I, 3)* Critical analysis of contemporary views on energy conversion and transformation in primary plant production. Topics include photosynthesis, phosphorylation, photorespiration, transport mechanisms, nitrogen assimilation, and symbiosis. *(Lec. 3) Pre: organic chemistry, plant physiology, biochemistry, or permission of instructor. In alternate years, next offered 1983-84.* Hull

591, 592 (or SLS 591, 592) Non-Thesis Research in Plant and Soil Science *(I and II, 1-3 each)* Advanced work under supervision of research staff to expand research experience into areas other than those related to thesis research. Arranged to suit individual requirements. *(Lab. 3-9) Pre: permission of instructor.* Staff

599 (or SLS 599) Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

699 (or SLS 699) Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

FOR Courses
Forest and Wildlife Management

401 Forest Influences *(I, 3)*
402 Wildlife Populations *(II, 3)*
423 Wetland Ecology *(I, 3)*
424 Wetlands and Land Use *(II, 3)*
491, 492 Special Projects *(I and II, 1-3 each)*

REM Courses
Resourse Mechanics

451 Soil Conservation Technology *(I, 3)*
484 Structures *(II, 3)*

Plant Pathology-Entomology

M.S., Ph.D., (Biological Sciences)

Graduate Faculty

Chairperson: Professor Richard W. Traxler, Ph.D., 1958, University of Texas
Professor Carl H. Beckman, Ph.D., 1953, University of Wisconsin
Professor Noel Jackson, Ph.D., 1960, University of Durham
Professor Walter C. Mueller, Ph.D., 1961, Cornell University
Associate Professor Richard A. Casagrande, Ph.D., 1975, Michigan State University
Associate Professor Larry Englander, Ph.D., 1973, Oregon State University
Assistant Professor Roger A. Lebrun, Ph.D., 1977, Cornell University
Assistant Professor Patrick A. Logan, Ph.D., 1977, Michigan State University
Adjunct Professor Arthur M. Kaplan, Ph.D., 1948, University of Massachusetts

Specializations

Plant pathology: disease resistance mechanisms, fine structure of pathogen-host interactions, epidemiology of turfgrass and woody ornamentals diseases. *Entomology:* insect ecology, pest management. *Plant protection:* plant disease and plant insect topics.

Master of Science

Admission requirements: GRE with undergraduate major in biological, agricultural, or physical sciences. Fundamental courses in biological sciences, mathematics, and chemistry may be required to make up deficiencies without graduate credit.

Deadline for the receipt of applications and all supporting documents is February 15 for September admission. We discourage application for mid-term or summer sessions.

Program requirements: coursework as determined by graduate committee, and thesis.

Doctor of Philosophy (Biological Sciences)

Limited to plant pathology specializations.

Admission requirements: GRE and preferably a master's degree in botany or plant pathology; other requirements same as master's degree; qualifying examination required if admitted without master's degree.

Program requirements: coursework as determined by graduate committee; dissertation.

PLP Courses
Plant Pathology-Entomology

401 Applied Insect Ecology *(II, 3)*
422 (or MIC 422) Industrial Microbiology *(II, 3)*
442 Diseases of Turfgrasses, Trees and Ornamental Shrubs *(II, 3)*
443 Plant Disease Laboratory *(I, 1)*
465 Etiology of Plant Disease *(I, 3)*
482 Nematology *(II, 3)*

511 The Nature of Plant Disease *(I, 3)* Analysis of the nature of plant disease, the processes of infection and pathogenesis, and the structural and physiological responses that determine resistance to disease. *(Lec. 3) Pre: BOT 332 or equivalent. In alternate years, next offered 1982-83.* Beckman and Mueller

561 Plant Virology *(I, 3)* Nature and properties of plant viruses, survey of plant diseases caused by viruses and experience in basic techniques. *(Lec. 3) Pre: BOT 332 or equivalent.* Mueller

571 Plants, Insects, and Pathogens *(II, 3)* A two-part investigation of insect-microbe associations, concentrating upon the comparative pathobiology of microbial agents in the insect host and the transmission of plant disease organisms by the insect vectors. *(Lec. 3) Pre: 381 (or ZOO 381) and MIC 211, or permission of instructor.* LeBrun

591, 592 Research Problems *(I and II, 1-3 each)* Individual or group study supervised by a faculty member in fields of plant virology, nematology and disease mechanisms, economic entomology or plant pathology, agricultural and industrial mycology, and related subjects. Written reports. *(Lec. 1-3, Lab. 2-6)* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Note: for other related courses see BOT 332, 432 and ZOO 381, 482, 581, 586.

Political Science

M.A., M.P.A.

Graduate Faculty

Chairperson: Professor Alfred G. Killilea, Ph.D., 1969, University of Chicago
Professor Timothy M. Hennessesy, Ph.D., 1968, University of North Carolina
Professor Edgar C. Leduc, Ph.D., 1963, Indiana University
Professor Josephine F. Milburn, Ph.D., 1956, Duke University
Professor Arthur Stein, Ph.D., 1965, University of Pennsylvania
Professor David D. Warren, Ph.D., 1959, Fletcher School of Law and Diplomacy
Professor Stephen B. Wood, Ph.D., 1964, University of Chicago
Professor Norman L. Zucker, Ph.D., 1960, Rutgers — The State University
Associate Professor Lawrence Rothstein, Ph.D., 1976, University of Massachusetts
Assistant Professor Karen E. Murphy, Ph.D., 1977, University of Southern California
Assistant Professor Gerry R. Tyler, Ph.D., 1972, Yale University

Specializations

American government, international relations, politics of the developing areas, urban affairs, comparative governments, public administration, political theory.

Master of Arts

Admission requirements: GRE with undergraduate credit in basic political science and political theory.

Program requirements: M.A. has a thesis and non-thesis option: non-thesis option requires one course including a substantial paper requiring significant independent research, oral examination in addition to comprehensive examination. An interdisciplinary program involving 15 additional credits in associate fields leads to a graduate certificate in International Development Studies awarded by the Dean of the Graduate School as an adjunct to the M.A. in political science. See International Studies (p. 57) for details.

Master of Public Administration

Admission requirements: generally, GRE with 1000 score (verbal plus quantitative) and 3.0 undergraduate grade-point average are required. Those who have taken the GREs and do not meet both of the requirements may be admitted based on other considerations.

Program requirements: non-thesis; one course including a substantial paper requiring significant independent research; comprehensive examination; internship; total of 36 credits, including PSC 501, 502, 503, 505, 506, 524, and 590. Competency in computer science and statistics is required and may be demonstrated by completion of a basic course at the undergraduate level or by examination.

Cooperative Program (M.P.A. and M.L.S.)

A cooperative program permits joint enrollment in the Master of Library Science and the Master of Public Administration programs, each of which requires a minimum of 36 credits when taken separately. The integrated pursuit of the two degrees makes it possible for 9 credits of appropriately selected coursework from one program to serve as electives in the other, and for 6 credits of such coursework to be applied in the opposite direction. Thus, when planned and taken jointly, the two programs can be completed with a total of 57 credits.

Admission requirements: GRE and other requirements listed for M.L.S. and M.P.A. Applicant must apply and be accepted in both programs. Applications (in quadruplicate) must indicate M.L.S./M.P.A. as the field of specialization.

Program requirements: Each student must complete the required core courses for both programs plus 3 credits of PSC 590 for the M.P.A. and 3 credits chosen from LSC 520, 521, 522 or 533 for the M.L.S. Students must file separate programs of study for each degree, indicating the courses to be jointly counted. Each student must pass the separate comprehensive examination for each degree. A student who fails to complete one of the programs may, of course, complete the other in accordance with the separate program of study.

PSC Courses
Political Science

401 Comparative European Politics *(I and II, 3)*
407 The Soviet Union: Politics and Society *(II, 3)*
408 African Government and Politics *(I, 3)*
420 Dissent, Non-Violence and Change *(I, 3)*
422 Comparative American State Politics *(II, 3)*
431 International Relations *(I, 3)*
432 International Government *(II, 3)*
434 American Foreign Policy *(II, 3)*
443 Twentieth-Century Political Theory *(I, 3)*
444 Marxist Political Thought *(II, 3)*
455, 456 Directed Study or Research *(I and II, 3 each)*
460 Urban Politics *(I and II, 3)*
461 The American Presidency *(I, 3)*
464 International Law *(II, 3)*
466 Urban Problems *(II, 3)*
470 Problems and Principles in the American Political Process *(II, 3)*
471 Constitutional Law *(I, 3)*
472 Civil Liberties *(II, 3)*
474 Criminal Justice Systems *(II, 3)*
481, 482 Political Science Seminar *(I and II, 3 each)*
483 Political Process: Policy Formulation and Execution *(I or II, 3)*
486 Cooperative Communities *(II, 3)*
491 Principles of Public Administration *(I, 3)*
495 Comparative Urban Politics *(I, 3)*
498 Public Administration and Policy Formulation *(II, 3)*

501 Administrative Theory *(I and II, 3)* Theoretical constructs and models in fields of public administration; theories of Weber, Riggs, Dorsey, Simon, Presthus. Lower level models in subfields of organization, communications, and decision making. Task-oriented subject matter such as personnel, budget, and program administration related to theoretical formulations which seek to explain them. *(Lec. 3) Pre: 491 or permission of department.* Grossbard

502 Techniques of Public Management *(I and II, 3)* Principles and techniques employed in the administration of staff activities of the public service such as administrative planning, project scheduling, and budgeting. *(Lec. 3) Pre: 491 or permission of department.* Staff

503 Problems in Public Personnel Administration *(I or II, 3)* Development of personnel administration, including problems of recruitment, examination, promotion, and staffing within public service. Emphasis on evaluation of employee performance and collective bargaining in public service. *(Lec. 3) Pre: graduate standing or permission of department.* Murphy

505 (or SOC 505) Public Program Evaluation *(II, 3)* Research design and methodologies associated with the evaluation of governmental programs and activities. *(Lec. 3) Pre: EST 408 or equivalent or permission of instructor.* Hennessey

506 Seminar in Budgetary Politics *(I, 3)* Examination of federal, state and local fiscal and budgetary processes, focusing on the politics of the budgetary process and models of budgeting, with emphasis on contemporary issues. *(Sem. 3)* Murphy

507 The U.S.S.R. and China in World Affairs *(II, 3)* Seminar of Russian and Chinese world outlook and study of their foreign policies — how they deal with each other, the West, other communist nations and developing nations. *(Lec. 3) Pre: 407 or department approval.* Stein

510 Developing Nation State: Africa *(II, 3)* Analysis of developmental policy formation with emphasis upon the governmental processes in the new nations with major focus on African countries. *(Lec. 3) Pre: permission of instructor.* Milburn

512 (or GMA 512) Seminar in Marine Science Policy and Public Law *(II, 3)* Multidisciplinary teams of faculty and selected graduate students tackle unresolved problems in creating rules or institutions to cope with new uses of the marine environment, e.g., freedom of the seas, fisheries regulation, deep-sea mining, or weather modification. Team meetings at team convenience; plenary sessions; backup studies for team meetings plus final report. *Pre: permission of department.* Cameron

522 Comparative American Local Politics *(I, 3)* Comparative study of American local government and politics. Emphasis on the determinants of local public policy. *(Lec. 3) Pre: 221 or urban related course, EST 408.* Leduc

523 Seminar in Comparative Public Administration *(I, 3)* Theory, practice, and organization of selected European and developing nations' administrative systems. Analysis of selected policies. Influence of English and French systems on developing systems. Structure-function and ecological analysis. *(Sem. 3) Pre: 491, 501 or permission of instructor.* Milburn

524 Seminar in Public Policy Problems *(I and II, 3)* Exploration in depth of selected problems of policy formulation — intergovernmental relations, regionalization, citizen participation and control, priority setting for public sector programs. *(Lec. 3) Pre: 491, 501 or permission of department.* Grossbard

544 Democracy and Its Critics *(I, 3)* Seminar examining the roots of modern democracy in the social contract theories and analyzing the quality and limits of self-determination in these theories in the light of contempory politics. *(Lec. 3) Pre: 341, 342, or permission of department.* Killilea

555, 556 Directed Study or Research *(I and II, 3 each)* Special work arranged to meet the individual needs of graduate students in political science. *(Lec. 3) Pre: permission of department.* Staff

568 Jurisprudence *(II, 3)* Introduction to the philosophy of law, treating the sources, the nature, and the consequences of major systems of legal thought. Emphasis on the relationship between legal reasoning and judicial decision-making in the United States. *(Lec. 3) Pre: 471, 472, or permission of instructor. In alternate years, next offered 1983-84.* Wood

573 Administrative Law *(I, 3)* Legal aspects of interaction between government agencies, individuals, and public interest. Systematic analysis of leading cases, evaluating the courts as an instrument for protecting the individual's rights in administrative action. *(Lec. 3) Pre: 113.* Rothstein

577 International Ocean Law
See Geography and Marine Affairs 577.

590 Internship in Public Administration *(I and II, 3-6)* Participation at an administrative agency under supervision of agency head and a member of the faculty. Planning, personnel management, research organization, budgeting, interdepartmental relations, informal liaisons that are the hallmark of effective administration. *May be taken as one 6-credit unit or two 3-credit units. Pre: permission of Bureau of Government Research.* Staff

595 Problems of Modernization in Developing Nations
See Resource Economics 595.

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Psychology

M.S., Ph.D.

Graduate Faculty

Chairperson: Professor Albert J. Lott, Ph.D., 1958, University of Colorado
Professor Stanley I. Berger, Ph.D., 1957, University of Kansas
Professor Allan Berman, Ph.D., 1968, Louisiana State University
Professor Henry B. Biller, Ph.D., 1967, Duke University
Professor Lawrence C. Grebstein, Ph.D., 1964, University of Kentucky
Professor Bernice Lott, Ph.D., 1954, University of California, Los Angeles
Professor Peter F. Merenda, Ph.D., 1957, University of Wisconsin
Professor James O. Prochaska, Ph.D., 1969, Wayne State University
Professor Albert Silverstein, Ph.D., 1963, University of California
Professor Nelson F. Smith, Ph.D., 1963, Princeton University
Professor Wayne F. Velicer, Ph.D., 1973, Purdue University
Professor William T. Vosburgh, Ph.D., 1965, Syracuse University
Professor Alan Willoughby, Ph.D., 1959, University of Connecticut
Associate Professor Jerry L. Cohen, Ph.D., 1973, University of Illinois
Associate Professor Charles E. Collyer, Ph.D., 1976, Princeton University
Associate Professor Ira Gross, Ph.D., 1967, University of Illinois
Associate Professor Janet Kulberg, Ph.D., 1967, George Peabody College
Associate Professor Kathryn Quina-Holland, Ph.D., 1973, University of Georgia
Associate Professor John F. Stevenson, Ph.D., 1974, University of Michigan
Associate Professor Dominic Valentino, Ph.D., 1971, University of California
Assistant Professor Paul R. Florin, Ph.D., 1981, George Peabody College of Vanderbilt University
Assistant Professor Robert B. Germain, Ph.D., 1977, University of Texas, Austin
Assistant Professor Mark D. Rapport, Ph.D., 1980, Florida State University

Specializations

Programs: clinical, experimental and school psychology; specialties are offered within the program. The clinical program offers a specialty in family clinical. Students in the experimental program tend to concentrate in one of the following five areas: (1) human perception and learning; (2) conditioning and behavior change; (3) psychophysiology; (4) methodology and quantitative psychology; (5) personality/social/community basis of behavior. Additional individual specialties can be developed within each of the program areas.

Master of Science (School Psychology Only)

Admission requirements: GRE with advanced test. Undergraduate major in psychology recommended. Applicants are admitted for September only. Applications must be completed by February 15.

Program requirements: non-thesis; internship; total of 60 credits of which a minimum of 30 for the master's degree plus additional credits for certification as a school psychologist; one course with major paper involving a significant independent research; written comprehensive examination.

Doctor of Philosophy (Clinical, Experimental, and School Psychology)

Admission requirements: GRE with advanced test; evidence of research competency. Applicants are admitted for September only. Applications must be completed by February 1 for clinical, by February 15 for school, and by March 1 for experimental. Prospective applicants are asked to address initial inquiries concerning the desired specialization to the department, but formal application materials must be obtained from and returned directly to the Graduate School Office. Applicants to clinical program having post-baccalaureate experience are given special consideration.

Due to limited facilities, new admissions to the doctoral programs must be limited to a small number per year. Although test scores and cumulative averages are not the sole criteria for admission, those with overall quality point averages of less than 3.0 on a 4.0 scale, or whose two highest GRE scores do not total above 1200, are advised that there is little chance for admission.

Program requirements: completion of a minimum of 90 credits (72 plus 18 for dissertation). Language requirement optional depending upon requirements set forth by student's program committee. Research course requirements: a minimum of 2 courses in statistics (PSY 510/532) and a research methods course (PSY 611). Research competency requirement may be met by successfully defending a master's thesis or by successfully completing a research competency project under the direction of the major professor. Students who choose the thesis option and are successful in its defense will earn a Master of Arts degree in psychology. A Ph.D. qualifying examination is required of all doctoral students entering without the master's degree. This requirement is met by completing four core courses from PSY 510, 532, 611, and those numbered 601-608, with a grade of B or better. These courses are usually completed prior to the earning of 24-30 credits. For students in the applied areas (clinical and school) at least one core course must be completed in each of the following content areas of psychology: biological bases of behavior; cognitive and affective bases; social bases; individual differences; and history and systems of psychology.

The objective of our Ph.D. program is to give our students the knowledge and skills they will need to be effective psychologists in their chosen area. Scientific training and research experience as well as knowledge and technical skills are a part of each student's program, but his or her program is individually designed around his or her needs and goals.

In the clinical and school programs, practicum and individual research projects can be specifically tailored to help the student prepare for the professional role of his or her choice. These programs also have a strong experiential base including field activity in each year. Students are expected to be involved in research for a substantial portion of their program.

The department emphasizes a close working relationship between faculty and students. No single theoretical or philosophical model is espoused.

PSY Courses
Psychology

432 Advanced Developmental Psychology *(II, 3)*
434 Introduction to Psychological Testing *(I and II, 3)*
436 (or PCL 436) Psychotropic Drugs and Therapy *(II, 3)*
438 (or PCL 438) Psychotropic Drugs and Behavior *(I or II, 3)*
442 The Exceptional Individual *(I or II, 3)*
450 Cognitive and Behavioral Analysis of Communication *(II, 3)*
454 Group Processes *(I, 3)*
456 Research Methods in Social Psychology *(II, 4)*
461 The Alcohol Troubled Person: Psychological and Social Issues *(I or II, 3)*
464 Humanistic Psychology *(II, 3)*
410 Topics in Social Psychology *(I, 3)*
479 Contemporary Problems for Modern Psychology *(I and II, 3-12)*
480 The Female Experience *(II, 3)*
489 Problems in Psychology *(I and II, 3)*
499 Psychology Practicum *(I and II, 1-6)*

505 Community Psychology *(I, 3)* Introduction to community psychology; study and change of individual's interaction with community systems; theoretical and empirical models, intervention strategies, and research methods relevant to community psychology. *(Lec. 3) Pre: permission of department.* Stevenson

510 Intermediate Quantitative Methods *(II, 3)* Complex statistical techniques useful in practical psychological research, including multiple correlation and regression analysis, multiple correction for restriction in range, and introductory multivariate analysis methods. Practical applications utilizing

SPSS, and Cooley and Lohnes Computer Program. *(Lec. 3) Pre: permission of department.* Merenda

517 (or EST 517) Small N Designs *(II, 3)* A survey of Small N experimental methodology, including hypothesis of quasi-experimental designs and the application of interrupted time series. Applications in applied research, particularly behavioral intervention. *(Lec. 3) Pre: 510, 532. In alternate years.* Velicer

520 Psychometric Methods *(I or II, 3)* Techniques for investigating areas of attitude and opinion research, morale and leadership, personality and perception. Includes techniques of test construction. Q-methodology, and psychometric scaling. *(Lec. 3) Pre: 434, 510. In alternate years.* Merenda

522 Behavioral Assessment Techniques *(II, 3)* Interview, observational, questionnaire, self-monitoring, cognitive behavior modification, and analogue assessment procedures are reviewed in terms of their use and interpretation of behavior in clinical, institutional, home, and school settings. *Alternate odd-numbered years. Pre: 434, 550.* Staff

532 Experimental Design
See Experimental Statistics 532.

534 Clinical Interpretation of Standardized Psychological Tests *(II, 3)* Clinical use of standardized assessment techniques such as MMPI. Critical review of theory and research underlying objective, group assessment of human characteristics. Development and interpretation of individualized evaluations based on profile analysis. *(Lec. 3) Pre: 434.* Staff

540 (or EDC 540) Learning Disabilities: Assessment and Intervention *(SS, 3)* Applications of early screening batteries; remedial programs for various disabilities, developing treatment exercises, behavioral programs, and programs for older children and adolescents. Emphasis on pragmatic application of skills for detection and treatment. *(Lec. 3) May be repeated for credit once as A and B. Pre: permission of instructor.* Berman

550 (or PCL 550) Operant Analysis of Behavior *(I or II, 3)* Introduction to the principles of operant conditioning with emphasis on the use of these principles in the analysis of behavior. *(Lec. 3) Pre: permission of department.* Smith

554 Alternate Therapies *(I or II, 3)* Theory and practice of those individual and group techniques which can be integrated into one's present style of helping; (a) existential, (b) body therapies, (c) cognitive therapies, and (d) other contemporary approaches. Students may participate in a maximum of five distinct workshops. *(Lec. 2, Lab. 2) Pre: professional and/or graduate status and permission of the coordinator.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

601 Physiological Psychology *(II, 3)* An advanced consideration of physiological research on neural, endocrine, and response systems as it relates to attention, motivation, emotion, memory and psychological disorders. *(Lec. 3) Pre: permission of department.* Valentino

602 Learning and Motivation *(II, 3)* Empirical and theoretical analysis of the basic principles of acquisition and loss of habits. Topically organized to deal with respondent and operant conditioning, and their relationship to reinforcement and motivation. *(Lec. 3) Pre: undergraduate learning course and permission of department.* Silverstein

603 Development *(II, 3)* Theoretical, methodological, and applied issues in lifespan development, including cognitive, perceptual, psychomotor, affective and social development. Topically organized. *(Lec. 3) Pre: permission of department.* Kulberg, Biller and Staff

604 Perception and Cognition *(I, 3)* A survey of topics in sensation, psychophysics, perception, memory, and attention, with an emphasis on how important issues have been formulated, and the relation of these issues to general psychology. *(Lec. 3) Pre: permission of department.* Collyer

605 Personality *(I or II, 3)* Reading of primary source materials from major personality theorists relevant to a particular topical emphasis. Application and comparative evaluation of the theories studied. *(Lec. 3) Pre: permission of department.* Stevenson and Staff

606 Social Psychology *(I, 3)* Intensive exploration of the methods, theory, and data base of contemporary social psychology focusing on salient issues that clarify significant topics in this area. *(Lec. 3) Pre: permission of department.* A. Lott

608 Theories and Systems *(I, 3)* An in-depth analysis of the origin and logical structure of major systematic approaches to psychology. Emphasis on significant recurrent controversies. *(Lec. 3) Pre: graduate standing.* Staff

610 (or EST 610) Factor Analysis *(I, 3)* Comparison among various procedures of factor analysis including tetrad differences, bi-factor, group centroid, principal component, canonical methods, and image analysis. Estimation of factor loadings and specific variances. Methods for factor rotation. Exploratory versus confirmatory factor analysis. Estimation of factor scores. Practical applications utilizing SPSS, and Cooley and Lohnes Computer Programs. *(Lec. 3) Pre: EST 541 or equivalent. In alternate years, next offered 1982-83.* Merenda

611 Methods of Psychological Research and Experimental Design *(I, 3)* Provides the student of psychology with a knowledge of research methodology and the techniques of experimental designs. It prepares for the development of thesis problems of graduate students in psychology and related disciplines. *(Lec. 3) Pre: 510, 532.* Merenda and Staff

615 Collaborative Research in Psychology *(I or II, 0-3)* Collaborative approaches to psychological research. Special emphasis on topics that can involve students at varying levels of research skill. Format includes weekly topical seminar and biweekly colloquium combining all topical interest groups. *(Sem. 3, Colloquium 1) Pre: 300, 301, 532 or equivalent and permission. May be repeated. Maximum of six credits.* Kulberg and Staff

616 Methodology and Design in Research in School Psychology *(I or II, 3)* Models of research design and methodology particularly applicable to the school situation are explored. *(Lec. 3) Pre: 510, 532, permission of department.* Staff

617 Methodology and Design in Research in Clinical Psychology *(I or II, 3)* Models of research design and methodology particularly pertinent to the area of clinical psychology with emphasis on mental designs appropriate to research problems, using specific experiments and original research. *(Lec. 3) Pre: 510, 532, permission of department.* Biller

620 Seminar: Classical Conditioning *(I and II, 3)* History and nature of the conditional reflex, with emphasis placed on understanding the role of the conditional reflex and contemporary behavioral research and theory. *(Lec. 3) Pre: permission of department.* Smith

621 Seminar: Human Learning and Memory *(I or II, 3)* Experimental analysis of major problem topics of learning and retention studies in humans. Emphasis on systematic studies of verbal habits, dimensional analysis of the critical variables influencing these habits, and the interference theory of forgetting. *(Lec. 3) Pre: permission of department.* Silverstein

625 Seminar: Social Psychology *(II, 3)* Attention on a major area in contemporary social psychology. Empirical studies analyzed for their relevance to theoretical and applied issues; students will design an original investigation. *(Sem.) Pre: graduate standing or permission of instructor. May be repeated twice with a change of topic.* A. Lott, B. Lott, J. Cohen, and J. Stevenson

641 Introduction to Psychotherapy *(I, 3)* A trans-theoretical analysis of the major systems of psychotherapy. Developing an integrative, eclectic model through identifying the processes of change that are the core of effective therapy. *(Lec. 3) Pre: permission of department.* Prochaska

644 Family Therapy *(I, 3)* Introduction to theories and techniques of family assessment and family therapy. Seminar format with videotape illustrations, case presentation and discussion, role playing, lecture, and selected experiential exercises. *(Lec. 3) Pre: permission of instructor.* Grebstein

645 Marital and Sexual Therapy *(I, 3)* Behavioral, psychodynamic, and systems perspective on marital and sexual problems and treatments. Theory and research applied in supervised practice with troubled couples. *(Lec. 3) Pre: permission of department.* Prochaska

646 Group Therapy *(I, 3)* Theory, research, and change strategies developed in working with small groups. Current research, models, and techniques will be discussed in the context of actual clinical work with groups. *(Lec. 3) Alternate years. Pre: permission of instructor.* Grebstein

647 Child Therapy *(I, 3)* Seminar discusses issues, techniques, and research related to behavior changes in children and their families. Aspects of therapy, the role of behavioral approaches and the participation of parents will be explored. Direct, supervised experience is included in this course. *(Lec. 3) Pre: participation in the Psychological Consultation Center. Permission of department.* Staff

660 Personality Dynamics II (Advanced Psychopathology) *(I or II, 3)* Empirical literature with regard to etiological factors involved in the formation of pathological character trends and deviations. Evaluation of clinical theory and classification systems as related to the psychotherapeutic process. *(Lec. 3) Pre: permission of department.* Prochaska

661 Psychological Services I (Administration and Interpretation of Cognitive Tests) *(I, 3)* Instruction and practice in administration and interpretation of cognitive tests; individual intelligence tests of both general and specific abilities. Rationale, research evidence, clinical application of Stanford-Binet, Wechsler, McCarty scales. *(Lec. 3) Pre: permission of department.* Berman

662 Psychological Services II (Administration and Interpretation of Personality Tests) *(II, 3)* Instruction and practice in the administration and interpretation of instruments used in the assessment of personality. Emphasis upon projective tests such as Rorschach, TAT. Rationale, research evidence and clinical application. *(Lec. 3) Pre: permission of department.* Staff

663 Seminar to Accompany Field Experience in Psychological Services *(I and II, 3)* All students meet in seminar to discuss and investigate specific diagnostic, therapeutic, research problems emerging in connection with internship experience. *(Lec. 3) Pre: 670.* Staff

664 Advanced Diagnostic Problems *(II, 3)* Use and interpretation of cognitive, projective, and neural psychological tests. Focus on integrating data into meaningful description of total personality functioning. Use of the diagnostic interview. *(Lec. 3) Pre: 661, 662 and permission of instructor. In alternate years.* Berman

665 Seminar: Behavior Disorders in Childhood *(I or II, 3)* Emphasis on etiological factors, diagnostic and treatment consideration, and experimental research findings related to the psychological maladjustments in infancy and childhood; treatment procedures, resources and methods used in dealing with behavior and personality problems. Lectures, discussions, and case demonstrations. *(Lec. 3) Pre: 660. In alternate years, next offered 1983-84.* Berman

666 Seminar: The Professional Psychologist in the Community *(I and II, 1-3)* Ethical and professional standards related to the practice of psychological services. Discussion and guest lectures by members of related disciplines. Special emphasis upon the role of the professional psychologist in the community: (a) clinical psychology, (b) school psychology. *(Lec. 1-3) Pre: permission of department.* Staff

668 School Psychological Consultation *(II, 3)* Historical and contemporary perspectives on consultation are discussed in terms of mental health and psychoeducational services. The focus is on the content and process of consultation in various clinical and educational settings. *(Sem.) Pre: 666 or equivalent.* Staff

670 Field Experience in Psychological Services *(I and II, 1-12)* Training placements and internships are available in a variety of institutional agencies and school settings under supervision which must be acceptable to the department: (a) school, (b) experimental areas, (c) clinical. *Pre: permission of department.* Staff

671 Clinical Practices I (Diagnostic) *(I or II, 3)* Supervised practice in the assessment of problem behavior. Emphasis on the integration of data from psychological tests, case histories, and other sources in the assessment of personality. Practicum facilities available in several agenices. *(Lec. 2, Lab. 2) Pre: 661, 662, and permission of department. In alternate years, next offered 1983-84.* Berger

672 Individual Clinical Practicum *(I or II, 3-9)* Introductory experience in dealing with clinical problems in a variety of clinical settings. Individual supervision to be arranged. *(Lec. 3) May be repeated up to three times. Pre: 661, 662 and permission of department.* Staff

673 Seminar: Introduction to Clinical Psychotherapy *(I, 3)* Theories and techniques of psychotherapeutic procedures involving directive and nondirective and play therapies. Theoretical rationale and empirical research with special emphasis on the child area. *(Lec. 3) Pre: permission of department.* Willoughby and Staff

674 Clinical Practices II (Therapy) *(I or II, 3-12)* Specialized techniques of clinical interviewing, counseling, and psychotherapy. Critical discussions of student's own supervised therapy sessions: (a) individual, (b) behavior, (c) sensitivity, (d) specialized techniques. *(Lec. 3) May be repeated up to four times. Pre: 640, 660, 673, and permission of department.* Staff

675 Experimental Psychopathology *(I or II, 3)* Relates recent experimental methodology and findings to prevalent theoretical positions. Emphasis on reviewing experimental literature in specialized clinical areas. *(Lec. 3) Pre: permission of department.* Prochaska

676 Neurological Correlates of Psychopathology *(II, 3)* Functioning and physiology of central nervous system with particular attention to determining how neurological disruption and injury are manifested in behavioral disorder. Techniques used to evaluate and interpret neuro-psychological functioning. *(Lec. 3) Pre: permission of instructor. In alternate years, next offered 1983-84.* Berman

678 Seminar: Physiology of Learning and Memory *(II, 3)* Examination of theories of learning and memory in terms of biochemical changes and neurological processes. Neuroanatomy and function of higher brain systems are reviewed and related to learning and memory processes. *(Lec. 3) Pre: 381 or permission of instructor. In alternate years, next offered 1983-84.* Staff

680 School Practices I (Diagnostic) *(I and II, 3-9)* Testing procedures and devices in the diagnosis of organicity, personality problems, special learning problems, visual, auditory, and memory problems; includes administration, interpretation, and special adaptation of tests in the school situation. *(Lec. 3) May be repeated up to three times. Pre: 434, 661, or permission of department.* Staff

681 Special Problems in School Psychology *(I or II, 3-9)* Role of the psychologist in the school setting. Several theoretical and practical issues concerned with the value of psychological theory, administrative philosophy, and school organization are explored. *(Lec. 3) May be repeated up to three times. Pre: 680 and permission of department.* Vosburgh, Staff

682 Individual Practicum in School Psychology *(I or II, 3-9)* Accompanies student's internship in the school setting. Techniques for adapting psychological services to function within the school system. Individual supervision to be arranged. *(Lec. 3) May be repeated up to three times. Pre: permission of department.* Vosburgh

683 Psychology of the Exceptional Child *(I, 3)* Social, psychological and educational factors that constitute the matrix of concerns with the exceptional individual in the school

and community. Recent innovations in public and private education and habilitation. Research issues and legislation discussed evolve into student studies. *(Lec. 3) Pre: permission of department.* Staff

684 Learning Disabilities *(I, 3)* Introduction to developments in the field of disorders of learning in the school-age child, stressing recent conceptualizations of underlying psychological parameters essential to basic processes involved in learning. Interdisciplinary approaches to diagnosis; innovation of prescriptive teaching introduced. *(Lec. 3) Pre: 683 and/or permission of instructor.* Gross

685 Psychology of Mental Retardation *(II, 3)* Etiological factors, including biogenetic, physiological and social origin of mental retardation. The epidemiology and ecological aspects considered as they interact with social and cultural forces. Historical and current philosophy of habilitation and education of school-age children and adults. *(Lec. 3) Pre: permission of instructor.* Staff

686 Psychology and Education of the Emotionally Disturbed *(I, 3)* Current thinking on treatment and education of residential and day-care programs for the emotionally disturbed. Meaning of the various concepts of schizophrenia, autism, and hyperkinetic impulse disorder for treatment. Application of operant techniques for shaping socially appropriate behavior. Overview of origins of current operant methods in hospitals and schools. *(Lec. 3) Pre: permission of instructor.* Gross

690 Seminar: Contemporary Issues in Psychology *(I and II, 3-12)* Recent developments and current issues. Rigorous exploration of experimental and theoretical literature. Study limited each semester to one of the following areas: developmental, clinical, motivation, perception, psychophysics, and scaling problem solving and thinking. *A maximum of 4 seminars may be taken. (Lec. 3) Pre: permission of department.* Staff

692, 693 Directed Readings and Research Problems *(I or II, 3-6 each)* Directed readings and advanced research work under the supervision of a member of the staff arranged to suit the individual requirements of the students. *Pre: permission of department.* Staff

694 Special Problems in Clinical Psychology *(I or II, 3-12)* Instruction and clinical practicum training in unique problem areas of clinical psychology. Development of specialized evaluation instruments and procedures. *(Lec. 3) May be repeated up to four times. Pre: permission of department.* Staff

695 Seminar: Teaching Psychology *(II, 3)* Primarily a seminar in the teaching of psychology, at the undergraduate level. Includes a consideration of general issues in college teaching, preparation of a course proposal, and sample presentation. *(Lec. 3) Pre: permission of department.* Velicer, Stevenson, and Staff

696 Practicum: Teaching Psychology *(I or II, 3)* Practicum for students teaching a college level psychology course. Supervision of course preparation, presentation and evaluation. Individual supervision to be arranged. *(Lec. 3) Pre: 695 or permission of department.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Resource Chemistry

M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Section head: Professor George T. Felbeck, Jr., Ph.D., 1957, Pennsylvania State University
Associate Professor William R. Wright, Ph.D., 1972, University of Maryland

Specializations

Soil chemistry, soil biochemistry, soil genesis and classification, soil fertility and management, soil properties and land use, organic geochemistry.

Master of Science

Admission requirements: GRE and bachelor's degree with undergraduate major in biological or physical sciences. Applicants with course deficiencies may be required to take appropriate undergraduate courses without program credit.

Program requirements: Thesis and advanced courses selected on the basis of the student's background and interests.

Doctor of Philosophy (Biological Sciences)

Admission requirements: GRE and M.S. degree with thesis in biological or physical science.

Program requirements: Dissertation and advanced courses determined in consultation with the candidate's committee.

SLS Courses
Soil Science

401, 402 (or PLS 401, 402) Plant and Soil Science Seminar *(I and II, 1 each)*
411 Soil Chemistry *(II, 3)*
412 Soil Biochemistry *(II, 3)*
450 Soil Conservation and Land Use *(I, 3)*
468 Soil Genesis and Classification *(I, 4)*
478 (or PLS 478) Plant Biochemistry *(II, 3)*

501 to 504 Graduate Seminar in Plant and Soil Science
See Plant Science 501 to 504.

568 Recent Advances in Soil Science *(II, 3)* Critical analysis and presentation of technical reports of recent advances in soil science. Topics will vary according to background of students enrolled. With departmental permission can be taken more than once. *(Lec. 3) Pre: six credits in soil science or permission of instructor. In alternate years, next offered 1983-84.* Wright

591, 592 Non-Thesis Research in Plant and Soil Science
See Plant Science 591, 592.

599 Masters Thesis Research
See Plant Science 599.

699 Doctoral Dissertation Research
See Plant Science 699.

Resource Economics

M.S.

Graduate Faculty

Chairperson: Associate Professor Thomas F. Weaver, Ph.D., 1966, Cornell University
Professor John M. Gates, Ph.D., 1969, University of California
Professor Andreas Holmsen, Ph.D., 1960, Cornell University
Professor Harlan C. Lampe, B.S., 1949, University of Minnesota
Professor Niels Rorholm, Ph.D., 1954, University of Minnesota
Professor Irving A. Spaulding, Ph.D., 1944, Cornell University
Associate Professor Thomas A. Grigalunas, Ph.D., 1972, University oh Maryland
Associate Professor Jon G. Sutinen, Ph.D., 1973, University of Washington
Associate Professor William H. Wallace, M.S., 1951, University of New Hampshire
Assistant Professor Glen D. Anderson, Ph.D., 1981, University of Wisconsin, Madison
Assistant Professor Stephen R. Crutchfield, Ph.D., 1980, Yale University
Assistant Professor James J. Opaluch, Ph.D., 1979, University of California, Berkeley
Assistant Professor Timothy J. Tyrrell, Ph.D., 1978, Cornell University
Adjunct Professor Peder Andersen, Cand. Oecn., 1979, University of Aarhus

Specializations

Commercial fisheries management, international fisheries development, fisheries business economics, coastal zone land use and management, quality of the marine environment, aquaculture economics, offshore oil and gas management and natural resource pricing policies.

Master of Science

Admission requirements: GRE and a strong undergraduate record in economics is highly desirable.

Program requirements: thesis option: 24 hours of coursework including REN 534, written comprehensive examination, and thesis. Non-thesis option: 34 credits including REN 534, written comprehensive examination, and REN 591, with a substantial paper requiring significant independent research.

ECONOMICS - MARINE RESOURCES (Interdepartmental)

Ph.D.

This interdepartmental program offers study in the economics of marine resources. It is administered by the Department of Resource Economics with advice by graduate advisory faculty from several disciplines.

Graduate Faculty

Resource Economics: Associate Professor Weaver, *chairperson*. Professors Gates, Holmsen, Lampe, Rorholm, Spaulding; Associate professors Grigalunas, Sutinen, Wallace; Assistant Professors Anderson, Crutchfield, Opaluch, Tyrrell; Adjunct Assistant Professor Andersen.

Economics: Associate Professors Ramsay, Suzawa; Assistant Professor Mead.

College of Business Administration: Professors Della Bitta, Jarrett, Mojena, Rogers; Associate Professors Callaghan, Comerford, Dash, Lord.

Specializations (Ph.D.)

Commercial fisheries management, international fisheries development, coastal zone land use and management, quality of the marine environment, aquacultural economics, offshore oil and gas management, and natural resource pricing policies.

Admission requirements: GRE including the advanced test in economics, six semester hours of statistics and the following courses or their equivalents: ECN 327, 328 and 375.

Program requirements: The Ph.D. qualifying examination is required of students admitted without the master's degree. ECN 527, 576, 628; REN 534, 602, 630, 634, 635 and 676. Additional courses may be elected from appropriate offerings in economics, resource economics, engineering, geography, oceanography, mathematics, political science, statistics, computer science, and management science. The dissertation will be written on a problem involving marine resources or an associated industry, such as minerals, petroleum, fisheries, water, transportation, recreation, or waste disposal.

REN Courses
Resource Economics

410 Economics of Natural Resource Use *(I, 3)*

430 International Resource Development *(II, 3)*

435 Acquacultural Economics *(II, 4)*

440 Benefit-Cost Analysis *(II, 3)*

455 Economics of Land, Forestry and Recreation Resources *(II, 3)*

460 Economics of Ocean Management *(II, 3)*

491, 492 Special Projects *(I and II, 1-3 each)*

514 Economics of Marine Resources *(I, 3)* Role of economics in development of marine resources. Particular attention to problems of multiple use of resources and to the conflicts between private and public goals. *(Lec. 3) Pre: M.M.A. students or permission of instructor.* Rorholm

527 Macroeconomic Theory
See Economics 527.

528 Microeconomic Theory
See Economics 528.

532 Land Resource Economics
See Community Planning 537.

534 Economics of Natural Resources *(II, 3)* Microeconomic theory applied to problems of natural resource allocation. The rationale for government intervention in the market's provision of natural resources and alternative techniques for optimally allocated natural resources are investigated. *(Lec. 3) Pre: ECN 528 and permission of instructor.* Anderson

543 Economic Structure of the Fishing Industry *(II, 3)* Analysis of U.S. world fishing industries from standpoint of activity and efficiency. Problems related to common property resources, government policy, labor, and legal and institutional factors. *(Lec. 3) Pre: 514 or permission of instructor.* Crutchfield and Holmsen

550 The Economics of Exhaustible Marine Resources *(II, 3)* Theory and application of natural resource analysis specifically applied to such marine resources as petroleum, sand and gravel, manganese, and other minerals. *(Lec. 3) Pre: ECN 328 or permission of instructor.* Grigalunas

576 Econometrics
See Economics 576.

591, 592 Special Projects *(I and II, 1-3 each)* Advanced work under staff supervision. Arranged to suit the individual requirement of the student. *Pre: permission of department.* Staff

595 (or ECN 595, GMA 595, PSC 595 or SOC 595) Problems of Modernization in Developing Nations *(II, 3)* Selected regional problems in the environmental complex, agricultural systems, population dynamics, distribution systems, political integration, urbanization-industrialization, popular participation, integrated theories of modernization. *(Lec. 3) Pre: permission of instructors.* Brand (Geography and Marine Affairs), Weaver (Resource Economics), Poggie (Sociology and Anthropology), Milburn (Political Science), and Suzawa (Economics)

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

602 Research Methodology *(I and II, 3)* Evaluation of alternative research methods and techniques. Development of specific research projects. *(Lec. 3) In alternate years beginning in 1983-84.* Gates

610 Advanced Studies *(I and II, 3)* Advanced topics in resource economics. Mathematical models in resource management. *(Lec. 3) May be repeated for different topics.* Staff

630 Resource Analysis
See Economics 630.

634 Economics of Resource Development II *(I, 3)* Concepts of economic efficiency applied to natural resources with emphasis on marine resources. Application of welfare and institutional economics to resource development; analysis of optimum allocation among users. *(Lec. 3) Pre: 534.* Opaluch

635 Marine Resources Policy *(I, 3)* Analysis of public policy problems relating to the development and management of marine resources, including fisheries, minerals, petroleum, water, and recreation. *(Lec. 3) Pre: 534. In alternate years beginning in 1982-83.* Grigalunas

676 Advanced Econometrics
See Economics 676.

677 Econometric Applications in Resource Economics *(II, 3)* Special topics in econometrics as applied to agriculture and natural resources. Topics include time series models. Bayesian analysis and dichotomous dependent variables. *Pre: 676.* Tyrrell

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Sociology

M.A.

Graduate Faculty

Chairperson: Professor Leo Carroll, Ph.D., 1974, Brown University
Professor Ralph W. England, Jr., Ph.D., 1954, University of Pennsylvania
Professor Robert V. Gardner, Ph.D., 1959, University of Illinois
Professor Richard J. Gelles, Ph.D., 1973, University of New Hampshire
Professor Carl Gersuny, Ph.D., 1968, Western Reserve University
Professor John J. Poggie, Jr., Ph.D., 1968, University of Minnesota
Professor Richard B. Pollnac, Ph.D., 1972, University of Missouri

Professor William R. Rosengren, M.A., 1963, Brown University
Professor Irving A. Spaulding, Ph.D., 1944, Cornell University
Associate Professor James D. Loy, Ph.D., 1969, Northwestern University
Associate Professor Mary E. Reilly, Ph.D., 1973, University of Massachusetts
Associate Professor William A. Turnbaugh, Ph.D., 1973, Harvard University
Assistant Professor Alexa Albert, Ph.D., 1978, Bryn Mawr College
Assistant Professor Marc A. Kelley, Ph.D., 1980, Case Western Reserve University
Assistant Professor Robert N. Lynch, Ph.D., 1971, University of Minnesota
Assistant Professor Calvin B. Peters, Ph.D., 1977, University of Kentucky
Assistant Professor Gail A. Shea, Ph.D., 1975, Brown University
Assistant Professor Richard V. Travisano, Ph.D., 1973, University of Minnesota

Admissions to the M.A. program in sociology have been suspended, and no applications are being accepted. For further information please contact the department directly.

SOC Courses
Sociology

410 Complex Organizations in Modern Society *(I or II, 3)*
414 Demography *(I or II, 3)*
416 Deviant Behavior *(II, 3)*
418 Collective Behavior *(I or II, 3)*
422 The Sociology of the Arts *(I or II, 3)*
423 Mortality and Morbidity *(I, 3)*
430 Social Pathology and Social Change *(I or II, 3)*
434 Urban Sociology *(I or II, 3)*
436 Sociology of Politics *(I or II, 3)*
438 Aging in Society *(II, 3)*
440 Sociology of Mental Disorder *(I or II, 3)*
442 Sociology of Education *(I or II, 3)*
444 Sociology of Religion *(I or II, 3)*
446 Sociology of Knowledge *(I or II, 3)*
452 Class and Power *(II, 3)*
492 History of Sociological Thought *(I or II, 3)*

501 Classical Sociological Theorists *(I, 3)* An in-depth study restricted to the works of Emile Durkheim, Karl Marx and Max Weber with an emphasis on their contributions to contemporary sociological thought. *Pre: 492 or permission of instructor.* Gardner

502 Contemporary Sociological Theory *(I or II, 3)* Critical examination of the theories and systems of contemporary sociologists. *(Lec. 3) Pre: 12 credits of sociology or permission of instructor.* Gardner

505 Public Program Evaluation
See Political Science 505.

507 Methods of Sociological Research *(I, 3)* The logic of sociological inquiry with particular emphasis on the interrelationship between theory and fact through an examination of a variety of methodological procedures. *(Lec. 3) Pre: graduate standing or permission of instructor.* Staff

508 Individual and Social Organization *(I or II, 3)* Sociology of the individual as the creator, preserver and participant in society. Emphasis upon symbolic interaction in the growth of personal idiom, the development of social structure, and of the content of social change. *(Lec. 3) Pre: permission of department.* Staff

510 Seminar in Deviance *(I or II, 3)* Deviation from social expectations analyzed as a social phenomenon. Emphasis on deviation theories and research pertaining to individuals, subcultures, and social systems. Discussions, oral and written reports. *(Lec. 3) Pre: permission of department.* England

513 Sexual Inequality *(I or II, 3)* Development of sexual inequality. Critique of various theories explaining inequality. Sociological interpretation of theories of sexuality. Some effects of inequality: American women; minority women; women's work. Discussion of liberation and androgyny. *(Lec. 3) Pre: 202, 342 or permission of instructor. In alternate years.* Reilly and Shea

516 Seminar in Law and Society *(II, 3)* Social forces in the creation and function of law in American society. Roles of law enforcers. Influences of social classes and interest groups on law as an instrument of social control and change. *(Lec. 3) Pre: 314 or 330 or permission of instructor.* England

518 Social Welfare: Planning and Policy *(II, 3)* Theories shaping attitudes toward institutional and residual welfare. U.S. programs and agencies, their development, scope, and format. Poverty and myths; welfare reform proposals and the role of social scientists. *(Lec. 3) Pre: 492, 507 or permission of instructor. In alternate years.* Reilly

520 Seminar in Sociological Topics *(I or II, 3)* Advanced study of selected topics in sociology. *(Lec. 3) Pre: graduate or senior standing, and permission of department.* Staff

521 Behavior Systems in Crime *(I, 3)* Criminal behavior studied in categories useful for sociological analysis. Linkages of criminal behavior systems to the larger society; behavior systems in causal theorizing, justice, prevention, and corrections. *(Lec. 3) Pre: 330 or equivalent. In alternate years.* Carroll and England

522 Issues in Corrections *(II, 3)* Justifications for punishment and corrections; historical development; intensive survey of current research on deterrence, effectiveness of treatment, prison, violence, and other issues. *(Lec. 3) Pre: 330, EST 408, SOC 507, or permission of instructor. In alternate years.* Carroll and England

523 Institutional Racism *(I, 3)* Consideration of varying models of race and ethnic relations; examination of recent research on issues such as residential segregation, school desegregation, affirmative action, and racial disorders; comparisons of U.S. with other societies. *(Lec. 3) Pre: EST 408, SOC 507 or permission of instructor. In alternate years.* Carroll and Reilly

524 Issues in Medical Care Delivery Systems *(II, 3)* Impediments to a broad extension of health care, access to health care, cost differentials, "technical" versus "humanistic" care, peer review and legal issues in medicine, cost benefits, evaluating delivery systems. *(Lec. 3) Pre: senior standing or graduate student status and permission of instructor. In alternate years.* Rosengren

552 Seminar in Teaching Undergraduate Sociology *(II, 3)* Seminar on issues and problems in instructing undergraduate sociology. Setting instructional goals, course planning, alternative course organizations, and relevant ancillary teaching materials. *(Lec. 3) Pre: permission of instructor. In alternate years.* Gelles

571, 572 Directed Study or Research *(I and II, 3 each)* Designed to cover areas of special research interests of graduate students not covered in other courses. *(Lec. 3) Pre: permission of department.* Staff

595 Problems of Modernization in Developing Nations
See Resource Economics 595.

598 Field Placement and Seminar *(I and II, 6)* Supervised field experience with an emphasis upon the application of sociological research to needs assessments, program planning, and evaluation; biweekly seminars; preparation of an original report based upon the placement experience. *Pre: EST 408, SOC 507 and permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

APG Courses
Anthropology

400 Bones, Mummies and Disease *(II, 3)*
401 History of Anthropological Theory *(I or II, 3)*
402 Methods of Anthropological Inquiry *(I or II, 3)*
405 Psychological Anthropology *(I or II, 3)*
407 Economic Anthropology *(I or II, 3)*
409 Anthropological Linguistics *(I or II, 3)*
412 Primate Behavior and Organization *(I or II, 3)*
413 (or GMA 413) Peoples of the Sea *(I, 3)*
470 Problems in Anthropology *(I and II, 3)*

Spanish

M.A.

See Languages on page 59.

Speech-Language Pathology and Audiology

M.A., M.S.

Graduate Faculty

Director of graduate programs: Assistant Professor Jay Singer, Ph.D., 1976, Case Western Reserve University
Professor Walter J. Beaupre, Ph.D., 1962, Columbia University
Professor Ruth M. FitzSimons, D. Ed., 1955, Boston University
Associate Professor Stephen D. Grubman, Ph.D., 1972, State University of New York, Buffalo
Associate Professor Raymond M. Hurley, Ph.D., 1975, University of Michigan
Clinical Assistant Professor J. Barry Regan, D. Ed., 1967, Boston University

Specializations

Audiology and speech/language pathology.

Master of Arts and Master of Science

Admission requirements: MAT or GRE; 24 undergraduate credit hours in speech science (always including CMD 372, 373, 374, and 375 or equivalents), general speech, child development, linguistics, psychology, education. Although test scores and cumulative average are not the sole determining criteria for admission to the graduate programs, in speech/language pathology and audiology, those applicants with overall quality point averages of less than 3.0 on a 4.0 scale, or whose highest GRE verbal scores are not 500 or above, or whose highest MAT scores are not 50 or above, are advised that there is little chance for admission.

Program requirements: for M.A. in speech/language pathology (42 credit hours), thesis, CMD 504, 26 credit hours in speech pathology, 7 credit hours in audiology. For M.A. in audiology (42 credit hours), thesis, CMD 504, 26 credit hours in audiology, 7 credit hours in speech pathology. For M.S. in speech/language pathology (42 credit hours), no thesis; written comprehensive examination; CMD 504, 32 credit hours in speech pathology and 7 credit hours in audiology. For M.S. in audiology (42 credit hours), no thesis; written comprehensive examination; CMD 504, 32 credit hours in audiology and 7 credit hours in speech pathology. For either the M.A. or M.S. programs in speech/language pathology or audiology, students must complete 25 hours of directed observations and a minimum of 300 supervised clock hours of practicum in addition to the academic requirements. Because program requirements in both speech/language pathology and audiology include clinical responsibilities, the average length of time to complete any of the programs is two academic years. Completed applications for either the summer or fall semester must be received no later than March 1. No applicants are admitted for January.

CMD Courses
Communicative Disorders

475 (SPE) Gestural Communication *(I, 2)*
491, 492 Special Problems *(I and II, 1-3 each)*

504 (SPE) Speech and Hearing Research *(I, 3)* Types of research in speech pathology, audiology, and communication science; critiques of representative models with special emphasis on experimental research; individual pilot projects or master's thesis. *(Lec. 3) Pre: 372, 373, 374, 375; graduate standing or permission of instructor.* Grubman

506 Speech and Hearing Science *(II, 3)* Critical analysis of experimental data concerning the parameters of speech and the fundamental concepts in normal audition. Course will include introduction to instrumentation. *(Lec. 1, Lab. 2) Pre: 504 or permission of instructor.* Hurley

551 (SPE) Measurement of Hearing *(I and II, 3)* Diagnostic protocols and practicum for routine audiological assessment; etiology and symptomatology of hearing disorders; overview of aural rehabilitation including hearing aids. *(Lec. 2, Lab. 1) Pre: graduate standing or permission of instructor, 372, 373, 374, 375.* Singer

552 (SPE) Advanced Measurement of Hearing *(II, 3)* Advanced audiometrics; speech audiometry; immittance measures, cochlear measures; retrocochlear measures; pseudohypacusis measures, and central auditory measures. *(Lec. 2, Lab. 2) Pre: 551 or permission of instructor.* Hurley

553 (SPE) Pediatric Audiology *(I, 3)* Theoretical and methodological approaches to the identification and management of children with auditory disorders. Topics discussed include auditory development, audiometric evaluation, and hearing aids. *(Lec. 3) Pre: 551 or permission of instructor.* Hurley

554 (SPE) Rehabilitative Audiology *(II, 3)* Theoretical and methodological approaches to aural rehabilitation of the hearing impaired adult. Topics discussed include use of amplification, speech reading, auditory training, and case management. *(Lec. 3) Pre: 551 or permission of instructor.* Hurley

555 (SPE) Amplification for the Hearing Impaired *(I, 3)* Electroacoustics and psychoacoustics of wearable hearing aids; selection and fitting procedures, counseling; classroom amplification systems. *(Lec. 3) Pre: 372, 373, 374, 375, graudate standing, or permission of instructor. Offered in alternate years.* Singer

556 (SPE) Automatic Audiometry *(II, 2)* Bekesy principle; continuous, discrete, and pulsetone measurements; diagnostic implications of various type tracings; research findings and current issues; practicum. *(Lec. 2) Pre: 552 or permission of instructor.* Regan

560 Disorders of Phonation *(II, 3)* Etiology and symptomatology of vocal pathology; intervention strategies for organic and functional voice disorders; emphasis on rehabilitation team approach to voice-resonance problems associated with cleft palate. *(Lec. 3) Pre: permission of instructor or graduate standing, 372, 373, 374, 375.* Beaupre

561 (SPE) Articulation Disorders *(I, 3)* Assessment, design, and implementation of therapeutic management programs for various speech production disorders at the articulatory and phonological levels. *(Lec. 3) Pre: 372, 373, 374, 375, or equivalent, or permission of instructor.* Grubman

564 (SPE) Disorders of Symbolization *(II, 3)* Study of language as a system of symbols for communication; types and causes of language symbolization disorders; rationale for case selection; differential diagnoses; therapies for language-learning disorders. *(Lec. 3) Pre: graduate standing and/or permission of instructor, 372, 373, 374, 375.* FitzSimons

567 (SPE) Clinical Practicum in Speech Pathology *(I and II, 1-3)* Supervised diagnostic and therapeutic procedures with persons experiencing communicative disorders. Differential diagnosis, parent counseling, and cooperation with allied personnel. Practicum held on campus and within institutional and school settings. *(Lab. 3-9) Pre: graduate standing.* Staff

568 (SPE) Clinical Practicum in Audiology *(I and II, 1-3)* Supervised clinical practicum concerned with audiological assessment of hearing disorders and auditory rehabilitation with the hearing impaired. Practicum held on campus and within institutional and school setting. *(Lab. 3-9) Pre: 551; graduate standing.* Staff

569 Diagnostic Procedures *(I, 3)* Major procedures for assessment and evaluation in Speech-Language Pathology. Implications of diagnostic data for referrals, prognosis, therapeutic programs, and consultations. *(Lec. 3) Pre: 372, 373, 374, 375, or equivalent or permission of instructor.* Grubman

572 (SPE) Medical Audiology *(II, 3)* Diagnostic implications of audiometry for

various organic disorders; supportive audiological information relevant to medical and surgical interventions; differential data associated with otosclerosis, Meniere's disease, VIIIth cranial nerve tumors, and malingering. *(Lec. 3) Pre: 372, 373, 374, 375; graduate standing or permission of instructor.* Staff

573 (SPE) Contemporary Problems in Audiology *(I, 3)* Critical review of current research and controversial issues within the profession; student selects one topic for independent study. *(Lec. 3) Pre: 372, 373, 374, 375; graduate standing or permission of instructor.* Staff

574 (SPE) Environmental Audiology *(II, 3)* Hearing problems in industry, in the military, and other high noise level environments; medico-legal aspects of hearing loss; hearing conservation programs in public schools. *(Lec. 3) Pre: 372, 373, 374, 375; graduate standing or permission of instructor.* Staff

577 Speech and Language for Hearing Impaired *(II, 3)* Assessment, development and/or maintainance of voice, speech and language skills associated with congenital or adventitious deafness; seminar approach to strategies in current practice with children and adults. *(Sem. 3) Pre: 372, 373, 374, 375; graduate standing or permission of instructor.* Beaupre

581 (SPE) Cerebral Palsy *(I, 3)* Identification of type of cerebral palsy by location of lesion, motor symptomatology and additional handicaps; role of the speech clinician on the team; types of speech therapy with emphasis on the Bobath approach; current research and controversial issues. *(Lec. 3) Pre: 372, 373, 374, 375; graduate standing or permission of instructor.* Grubman

584 (SPE) Delayed Speech and Language *(II, 3)* Problems in differential diagnosis for deafness, aphasia, autism, and learning disorders; demonstrations and critiques of clinical interventions with children who have speech and language learning deficits including dyslexia and acalculia. *(Lec. 3) Pre: 372, 373, 374, 375; graduate standing or permission of instructor.* FitzSimons

585 (SPE) Aphasia and Allied Language Disorders *(I, 3)* Types of adult aphasia; central and peripheral dysarthrias; role of speech clinician on the rehabilitation team; other degenerative disorders such as Parkinsonism and dystonia; current research and controversial issues. *(Lec. 3) Pre: 372, 373, 374, 375; graduate standing or permission of instructor.* Grubman

586 (SPE) Alaryngeal Speech *(II, 3)* Voice and speech rehabilitation for individuals without a functional larynx; social, emotional, and medical considerations; clinical procedures for esophageal, pharyngeal, and buccal speech; implications for use of artifical larynx; current research. *(Lec. 3)*

Pre: 372, 373, 374, 375; graduate standing or permission of instructor. Beaupre

591 Contemporary Issues in Speech and Language Pathology *(II, 3)* Critical review of selected current research and controversial issues in the profession. Topics will vary each offering. *May be repeated once for graduate program credit. (Sem. 3) Pre: minimum of 15 semester hours of graduate work in speech-language pathology, including 504, or permission of instructor.* Beaupre, Grubman, FitzSimons

592 Stuttering and Cluttering *(I, 3)* Study of nature and causes of stuttering; analyses of current theories and research concerning stuttering and cluttering; development of a rationale for diagnosis, case selection, and intervention. *(Lec. 3) Pre: graduate standing and/or permission of instructor.* FitzSimons

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Textiles, Clothing and Related Art

M.S.

Graduate Faculty

Chairperson: Associate Professor Patricia A. Helms, Ph.D., 1971, Florida State University
Associate Professor Patricia J. Weeden, M.S., 1961, University of Rhode Island
Assistant Professor Misako Higa, Ph.D., 1973, University of Minnesota
Assistant Professor Ernest H. Risch, Ed.D., 1979, Temple University
Assistant Professor Barbara J. Scruggs, Ph.D., 1976, Pennsylvania State University
Assistant Professor Linda M. Welters, Ph.D., 1981, University of Minnesota

The department offers a wide variety of individualized programs in close association with other departments such as history, art, chemistry, education, marketing, human development, counseling and family studies, and various social science fields.

Specializations

Apparel science, historic textiles and costume, marketing textiles, gerontology and other special populations.

Master of Science

Admission requirements: GRE and a bachelor's degree with adequate preparation for the proposed area of study.

Program requirements: thesis or non-thesis option, 30 credits.

For historic textile and costume specialization: thesis option: 24 credit hours of course work plus completion of a supervised internship; TXC 510, 500 or 546, 520, 530, EDC 529, TXC 599, plus 2-4 elective credits. Non-thesis option: 30 credit hours including TXC 510, 500 or 546, 520, 530, 550, 560, plus 5-7 elective credits as well as the completion of a supervised internship. A minimum of 9 credits is required to achieve a competency level in an allied field such as art history, history, sociology or anthropology. The committee may elect to waive this requirement if the candidate has had adequate preparation in the allied field as an undergraduate.

For other specializations: for thesis option: TXC 524, 533, EDC 529 or 3 credits in research methods selected in consultation with major professor; other courses chosen in accordance with student's background, interest, and needs; written comprehensive examination; oral defense of thesis. For non-thesis option: TXC 524, 533, 550, 560, EDC 529 or 3 credits of research methods selected in consultation with major professor; other courses chosen in accordance with student's background, interest and needs; written comprehensive examination. A maximum of 12 credits may be elected in allied fields for either thesis or non-thesis option.

TXC Courses
Textiles, Clothing and Related Art

403 Textile Performance *(II, 3)*
405 Advanced Clothing *(II, 2)*
416 Interior Design II *(I and II, 3)*
433 Textiles and Clothing Industry *(I and II, 3)*
440 Historic Textiles *(I, 3)*
455 Clothing for Special Needs *(II, 3)*

500 Ethnic Costume and Textiles *(II, 3)* Survey of regional styles of costume and textiles from all areas of the world, excluding fashionable dress. Influence of social, economic, technological, and aesthetic factors. *(Lec. 3) Pre: 224 or equivalent, 340, 440 or permission of instructor. Offered in alternate years, next offered spring 1984.* Welters

502 Seminar in Textiles and Clothing *(II, 3)* Original investigations in areas of clothing and textile production, marketing, and conservation. *(Lec. 3) Pre: at least one upper level undergraduate or graduate course in the area of investigation. May be repeated once with different topic.* Staff

503 Advanced Textiles *(I and II, 3)* Analysis of fabrics; methods and techniques of testing fabrics; evaluation of fabric data in relation to end-use performance and to existing quality standards. *(Lec. 2, Lab. 2) Pre: 303.* Helms

510 Historical Research Methods: Textiles and Furnishings *(I, 3)* Application of research methodology to the study of historic textiles, costume, furniture, and furnishings. Approaches primary sources, data collection, and research design. *(Lec. 3) Pre: 340, 440 or a course in historic furnishings, or permission of instructor.* Welters

513 Detergency *(II, 3)* Study of chemical and mechanical interactions of textile fibers, fabrics, laundering products, equipment, and soils. Laboratory experience in evaluation of laundry products and fabric durability during laundering. *(Lec. 2, Lab. 2) Pre: graduate standing, 303 or equivalent, and permission of instructor. In alternate years, next offered spring 1983.* Helms

520 Textile Conservation *(II, 3)* Introduction to storage and conservation of textiles and costume in the museum setting. Laboratory experience in conservation practices. *(Lec. 2, Lab. 2) Pre: 6 credits of textile science, permission of the instructor. Offered in alternate years, next offered spring 1983.* Welters

524 Social and Psychological Aspects of Textiles and Clothing *(II, 3)* Seminar in social and psychological aspects of textiles and clothing. Theories and assumptions concerning relevance of clothing to individuals and groups. *(Lec. 3) Pre: 224 or permission of instructor.* Scruggs

530 Historic Textile Internship *(I and II, 2-4)* Supervised internship designed to introduce student to management of textile and costume collections in museum or historical society setting. Individually designed to suit student needs—conservation, education, and research. *Restricted to TXC graduate students. Pre: 510, 520, or permission of department.* Welters

533 Textile and Clothing Economics *(I and II, 3)* Economic development of production and distribution of textiles and clothing. *(Lec. 3)* Helms

540 Special Problems in Textiles and Clothing *(I and II, 3)* Supervised independent study in specific areas of textiles and clothing. *Pre: permission of department.* Staff

546 Historic Furniture *(I, 3)* Chronological study of the development of furniture; factors which influence style and production; characteristics of style; and influence of historic furniture on later periods. *(Lec. 3) Pre: permission of instructor and previous course-work in history of art, architecture, interior, or furniture.* Higa

550 Seminar and Practicum *(I and II, 3)* Professional role of the textiles and clothing specialist. *Pre: permission of department.* Staff

560 Special Problems in Textiles and Clothing *(I and II, 3)* Supervised independent study in specific areas of textiles and clothing. *Pre: permission of department.* Staff

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Zoology

M.S., Ph.D. (Biological Sciences)

Graduate Faculty

Chairperson: Professor Charles E. Wilde, Jr., Ph.D., 1949, Princeton University
Professor Robert K. Chipman, Ph.D., 1963, Tulane University
Professor J. Stanley Cobb, Ph.D., 1969, University of Rhode Island
Professor Robert F. Costantino, Ph.D., 1967, Purdue University
Professor Clarence C. Goertemiller, Jr., Ph.D., 1964, Brown University
Professor Carl S. Hammen, Ph.D., 1958, Duke University
Professor Frank H. Heppner, Ph.D., 1967, University of California, Davis
Professor Robert B. Hill, Ph.D., 1957, Harvard University
Professor Kerwin E. Hyland, Jr., Ph.D., 1953, Duke University
Professor Saul B. Saila, Ph.D., 1952, Cornell University
Professor C. Robert Shoop, Ph.D., 1963, Tulane University
Professor Howard E. Winn, Ph.D., 1955, University of Michigan
Associate Professor Harold D. Bibb, Ph.D., 1969, University of Iowa
Associate Professor Robert C. Bullock, Ph.D., 1972, Harvard University
Associate Professor Nelson G. Hairston, Jr., Ph.D., 1977, University of Washington
Associate Professor Gabriele Kass-Simon, D.Phil., 1967, University of Zurich
Associate Professor William H. Krueger, Ph.D., 1967, Boston University
Associate Professor John P. Mottinger, Ph.D., 1968, Indiana University
Assistant Professor Peter V. August, Ph.D., 1981, Boston University
Assistant Professor Kerry R. Foresman, Ph.D., 1977, University of Idaho
Assistant Professor Marian R. Goldsmith, Ph.D., 1970, University of Pennsylvania
Adjunct Professor Dorothy E. Bliss, Ph.D., 1952, Radcliffe College
Adjunct Professor Donald J. Farish, Ph.D., 1969, Harvard University; J.D., 1976, University of Missouri
Adjunct Professor Robert H. Gibbs, Ph.D., 1955, Cornell University
Adjunct Professor Donald C. Miller, Ph.D., 1965, Duke University
Adjunct Professor Steven N. Treistman, Ph.D., 1972, University of North Carolina School of Medicine

Specializations

Acarology, animal behavior, cytology, ecology, electron microscopy, embryology, entomology, fisheries biology, genetics (developmental, ecological, population), herpetology, histology, ichthyology, invertebrate zoology, limnology, mammalogy, neurobiology, ornithology, parasitology, physiological ecology, physiology (cellular, comparative, mammalian), radioecology, reproductive biology, taxonomy, tissue culture, and molecular biology.

Master of Science

Admission requirements: GRE with advanced test (biology) and bachelor's degree

with major in zoology, biology or allied field. Applicants are normally admitted for September only. Applications should be completed by February 15.

Program requirements: thesis.

Doctor of Philosophy (Biological Sciences)

Admission requirements: master's degree is not required. GRE with advanced test (biology) and bachelor's degree with major in zoology, biology or allied field.

Program requirements: dissertation, two languages (one of which may be waived with faculty approval), qualifying examination required for all candidates except holders of M.S. degree.

ZOO Courses

Zoology

410 (or MIC 410) Introduction to Protistology *(II, 3)*
427 (or MCE 427) Modeling and Analysis of Dynamic Systems *(I, 3)*
442 Mammalian Physiology *(II, 3)*
455 (or BOT 455) Marine Ecology *(I, 3)*
457 (or BOT 457) Marine Ecology Laboratory *(I, 1)*
460 Advanced Population Biology *(II, 3)*
463 Animal Ecology *(II, 3)*
465 Limnology *(I, 4)*
466 Vertebrate Biology *(II, 3)*
467 Animal Behavior *(II, 3)*
475 Causes of Evolution *(II, 3)*
476 Human Genetics *(II, 3)*
482 Systematic Entomology *(II, 3)*

501 Systematic Zoology *(I, 3)* Species concepts and theories of biological classification. Taxonomic decisions and publication, numerical taxonomy, and review of the rules of zoological nomenclature. *(Lec. 3) Pre: ZOO (BOT) 262 and BOT (ASC) 352, 254 or 466 recommended. In alternate years, next offered 1983-84.* Bullock

505 Biological Photography *(I, 2)* Application of scientific photography to biological subjects, living and prepared. Photomacrography and photomicrography. Principles of photography as applied to the specialized needs of biological research and publication. *(Lab. 6) Pre: permission of instructor.* Heppner

508 Seminar in Zoological Literature *(II, 1)* Survey of zoological literature including traditional methods of bibliographic control, contemporary information retrieval services and the development of a personalized information system. *(Lec. 1) Pre: graduate standing in zoology.* Gleisner

510 Cell and Developmental Biology of the Motile Protista
See Microbiology 510.

512 Fine Structure *(II, 3)* Interpretation and integration of experimental evidence on the functional morphology or metazoan cells and their subcellar components and of the interstitium. Wherever feasible, study is carried down to the level of macromolecular or molecular structure. It includes a consideration of experimental methods. *(Lec. 2, Lab. 3) Pre: 323 or its equivalent.* Staff

518 Mechanisms of Development *(I, 2)* Current concepts of mechanisms responsible for developmental changes. Morphological, chemical, and genetic aspects of development are treated in discussions of morphogenetic movements, cell differentiation, and organogenesis. *(Lec. 2) Pre: 316 or 320 or equivalent; BOT 352 recommended.* Bibb, Goertemiller, Hufnagel, and Wilde

521 Recent Advances in Cell Biology
See Microbiology 521.

531 Advanced Parasitology Seminar *(II, 2)* Advanced topics in the host-parasite relationships of protozoan and metazoan parasites. Reading knowledge of one foreign language assumed. Topics vary from year to year. *(Lec. 2) Pre: 331 or equivalent.* Hyland

541, 542 Comparative Physiology *(I and II, 3 each)* Comparison of physiological mechanisms by which animals maintain life, emphasis on marine invertebrates. *541:* Responses to external environment mediated by receptors, nervous systems, effectors. Living control systems for muscular activity and circulation. Hill. *542:* Processes related to maintenance of internal environment, including osmotic balance, gaseous exchange and transport, nutrition, intermediary metabolism, nitrogen excretion, shell formation. *(Lec. 2, Lab. 3) Pre: 345 and 354. 541 is not prerequisite for 542.* Hammen and Hill

543 Biology of Reproduction in Animals *(I, 3)* Aspects of reproduction in animals of different phyla. Hormonal interrelationships, environmental control, and adaptive mechanisms. *(Lec. 2, Lab. 3) Pre: 345 and 545. In alternate years, next offered 1982-83.* Chipman

545 Endocrinology *(I, 3)* Anatomy, histology, embryology and physiology of endocrine glands. Emphasis will be placed upon recent biochemical/cell biological studies in mammals. *Pre: 316, 323; and 345 or 341 or equivalent. BCP 311 is recommended. In alternate years, next offered in 1983-84.* Staff

548 Neurophysiology *(II, 4)* Fundamental processes occurring in the nervous systems of invertebrates and vertebrates. Structure and functions of nervous elements with emphasis on integration and coodination. *(Lec. 3, Lab. 3) Pre: 345, MTH 141 or equivalent recommended and permission of instructor. In alternate years, next offered 1983-84.* Kass-Simon

549, 550, 551 Advanced Topics in Neurobiology *(II, 3 each)* Published papers in selected aspects of neurobiology will be discussed. Representative topics include role of Ca++, c-AMP in the nervous system, gating currents learning at the cellular level, cellular rhythmicity. *(Lec.-Disc. 3)* Kass-Simon

554 Seminar in Morphogenetic Theory *(II, 2)* Recent investigation in developmental physiology, and the control of differentiation and development. Reference to original papers. *(Lec. 2) Pre: 323 or equivalent, and permission of instructor.* Wilde

561 Behavioral Ecology *(I, 3)* The interaction of animal behavior, ecology and evolution. Topics include predator-prey relationships, resource partitioning, competition, territoriality, and reproductive behavior. Term project required. *(Lec. 1, Rec. 2) Pre: a course in animal behavior and a course in ecology. In alternate years, next offered 1983-84.* Cobb

562 Seminar in Behavioral Ecology *(I, 1)* Special topics in the relationships between animal behavior and ecology, such as social organization of animals, evolution of behavior, competition, and habitat selection. Discussion and presentation of individual reports. *(Lec. 1)* Cobb

563 Ichthyology *(I, 3)* Fishes of the world. Their structure, evolution, classification, ecology and physiology. Emphasis on local marine and freshwater fauna. Several field trips. *(Lec. 2, Lab. 3) Pre: 316 or 321 and 466.* Krueger

564 Oceanic Ichthyology *(II, 3)* Fishes of the great ocean basins. Their systematics, adaptations, vertical distribution, and zoogeography. Emphasis on mesopelagic and bathypelagic forms in the North Atlantic. *(Lec. 2, Lab. 3) Pre: 563 or permission of instructor. In alternate years, next offered 1983-84.* Krueger

565 Mammalogy *(II, 3)* Characteristics and adaptive significance of mammals encompassing their evolution, classification, distribution, life-histories, population dynamics, and behavior. Methods and techniques of identification, collection, and preparation of local mammals for study. Field work. *(Lec. 2, Lab. 3) Pre: 466 or equivalent. In alternate years, next offered 1982-83.* Chipman

566 Herpetology *(II, 3)* Biology of recent orders of amphibians and reptiles; emphasis on adaptations and evolution, world faunal relationships past and present, current systematic problems. Selected herpetological material in laboratory, field trips. *(Lec. 2, Lab. 3) Pre: 316 or 321 or permission of instructor.* Shoop

568 Ornithology *(II, 2)* Biology of birds, with emphasis on the role of birds in biological research. Areas covered include systematics, evolution, physiology, ecology and behavior. Discussion of current topics in ornithology. *(Lec. 2) Pre: 466 or permission of instructor.* Heppner

569 Vertebrate Field Study *(II, 3-4)* Vertebrate responses to various habitats; species composition; behavioral and physiological

interactions; methods of field research; extended field trips. *(Lec. 1, Lab 6 or 9) Pre: ZOO 466 and permission of instructor.* Chipman and Shoop

573 Developmental Genetics *(II, 3)* Genetic control of gametogenesis and fertilization. Survey of modern approaches to the problem of gene regulation during embryogenesis with animal systems. *(Lec. 3) Pre: BOT 352 or ASC 352 or equivalent and permission of instructor.* Surver

576 Ecological Genetics *(II, 4)* Hereditary structure of populations, population strategy in heterogeneous environment, species area-diversity patterns, strategy of colonization, stepping stones and biotic exchange. *(Lec. 3, Lab. 3) Pre: one semester of genetics.* Costantino

579 (or BOT 579) Advanced Genetics Seminar *(I and II, 1)* Current topics in genetics, including cytological, ecological, molecular, physiological, population, quantitative, and radiation genetics. *(Lec. 1) Pre: BOT 352 or ASC 352 and permission of instructor.* Costantino and Mottinger

581 General Acarology *(I, 3)* Detailed study of mites and ticks, their structure, life histories, and classification. Free-living forms as well as plant and animal feeders. *(Lab. 6) Pre: 331 or 481 or 586, and permission of instructor. In alternate years, next offered 1983-84.* Hyland

586 Medical and Veterinary Entomology *(II, 3)* Life histories, classifications, habits, and control of insects and other arthropods which affect the health of man and animals. Duties of the entomologist on public health team, including field practice in methods of insect surveys, control measures and subsequent surveys to determine success of control measures. *(Lec. 1, Lab. 4) Pre: 331 or 381 or equivalent. In alternate years, next offered 1982-83.* Hyland

599 Masters Thesis Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

640 to 645 Seminar in Physiology *(I and II, 1-3 each)* Reports and discussions on topics of current research in physiology. Subject matter adapted to meet interests of staff and students. *(Lec. 1-3) Pre: 345.* Hill and Staff

646 Advanced Mammalian Physiology *(II, 2)* Reports and discussions on topics of current research in mammalian physiology, coordinated with 442. Assigned research projects using advanced physiological techniques and instrumentation. *(Lec. 1, Lab. 3) Pre: concurrent enrollment in 442 or permission of instructor.* Hill

648, 649 Seminar in Environmental Physiology *(I and II, 2 each)* Reading, library research, special lectures on topics of current research interest in environmental physiology. *(Lec. 2) Pre: one year of physiology, and at least one course in ecology or permission of department.* Staff

664 Seminar in Ichthyology *(II, 2)* Reading, library research, reports and class discussion on problems of current research interest in the biology of fishes. *(Lec. 2) Pre: 563 or permission of department. In alternate years, next offered 1982-83.* Krueger

666 Physiological Ecology *(I, 3)* Comparative study of physiological adjustments which animals make in response to environmental factors, with emphasis on the physiological basis of animal distribution and evolution. *(Lec. 3) Pre: one year of physiology and a course in ecology.* Chipman

670 to 675 Advanced Ecology Seminars *(I and II, 2 each)* Specialized and advanced areas of ecological research and theory, including zoogeography, pleistocene ecology, population dynamics, energy flow in ecosystems, and radiation ecology. *Pre: 463 and permission of department.* Shoop, Hairston and Staff

679 Animal Communication
See Oceanography 679.

691, 692 Assigned Work *(I and II, 1-3 each)* Subject matter adapted to meet needs of student. May be arranged with any member of the staff, with the permission of the head of the department. *(Lec. 3 or Lab. 6)* Staff

693, 694 Zoological Problems *(I and II, 1-3 each)* Special work to meet needs of individual students who are prepared to undertake special problems. *(Lec. 1-3 or Lab. 2-6) Pre: permission of department chairman.* Staff

699 Doctoral Dissertation Research *(I and II)* Number of credits is determined each semester in consultation with the major professor or program committee.

Other Courses

The following are courses grouped by additional subject areas, or courses which may be taken for graduate credit, but are not part of a graduate program. Descriptions of the 400-level courses are to be found in the *Undergraduate Bulletin*. Where descriptions for 500-level courses are not provided, they will be found earlier in this catalog.

AAF Courses
African and Afro-American Studies

410 Issues in African Development *(I and II, 3)*

ART Courses
Art

403, 404 Studio – Seminar I and II *(I and II, 3-6 each)*
405, 406 Studio – Seminar III and IV *(I and II, 3-6 each)*
461 Topics in Methods, Theory and Criticism *(I or II, 3)*
462 Contemporary Art Seminar: Art Since 1945 *(II, 3)*
469, 470 Art History – Senior Projects *(I and II, 3-6 each)*
480 Advanced Topics in European and American Art *(I or II, 3)*
484 Advanced Topics in Architectural History *(I or II, 3)*

501, 502 Graduate Studio Seminar I and II *(I and II, 3 each)* Intensive independent studio work under guidance of instructors. Periodic critiques and discussions related to work of all participants in the course. *(Studio 6) Pre: 48 credits in studio for 501; 501 for 502.* Staff

DHY Courses
Dental Hygiene

462 Oral Care of the Aging and Chronically Ill *(I, 3)*
464 Field Experience in Community Oral Health *(II, 3)*

Genetics Courses

Animal and Veterinary Science
474 Population Genetics in Animal Breeding

Botany
554 Cytogenetics
579 Advanced Genetics Seminar

Microbiology
552 Microbial Genetics

Plant and Soil Science
472 Plant Improvement

Zoology
475 Causes of Evolution
476 Human Genetics

518 Mechanisms of Development
573 Developmental Genetics
576 Ecological Genetics
579 Advanced Genetics Seminar

Gerontology Courses

Human Development, Counseling and Family Studies
420 Human Development During Adulthood
421 Death, Dying and Bereavement
422 Aging: Case Coordination
431 Family and the Elderly
521 Developmental Issues in Later Life
555 Gerontological Counseling

Dental Hygiene
462 Oral Care for the Aging and/or Chronically Ill

Education
410, 411 Seminar and Supervised Field Practicum in Education of the Aging

Recreation
416 Physical Aging and Leisure Skill

Sociology
438 Aging in Society

HSS Courses
Human Science and Services

491, 492 Special Problems *(I or II, 1-3)*

JOR Courses
Journalism

400 Opinion and Interpretation in Journalism *(I and II, 3)*
434 Mass Media Issues *(I and II, 3)*
435 Theory of Communication *(I, 3)*
436 Fundamentals of Communication Research *(II, 3)*
438 Mass Media Law *(I and II, 3)*
441 International Communications *(I, 3)*
442 Independent Study and Projects in Mass Communications *(I and II, 1-3)*
452 Public Relations Principles and Publications *(I, 3)*
461 Internship in News Writing and Reporting *(I and II, 3)*
462 Internship in Editing *(I and II, 3)*
463 Internship in Broadcast Journalism *(I and II, 3)*

Latin American Studies Courses

Anthropology
470 Problems in Anthropology

History
580 Colloquium in Latin American History

Political Science
431 International Relations

Portuguese
497, 498 Directed Study

Spanish
470 Topics in Spanish-American Literature and Culture
497 Directed Study
571 Modern Spanish-American Authors
572 Evolution of Spanish-American Culture and Thought
590 The Hispanic Presence in the United States

Speech Communication
473 Intercultural Communication

NES Courses
New England Studies

400, 401, 402, 403 Special Topics in New England Studies *(SS, 1-3 each)*

500 Readings in New England Experience *(SS, 3)* Life in New England through the varying disciplines of the social sciences, the physical sciences, the humanities, and the arts. Each student will investigate a specific aspect of New England. *(Lec. 3)* Staff

RTH Courses
Respiratory Therapy

499 Special Problems *(I and II, 1-3)*

SPE Courses
Speech Communication

400 Rhetoric *(I, 3)*
410 Semantics *(II, 3)*
415 The Ethics of Persuasion *(II, 3)*
417 Speech in the Elementary School *(I and II, 3)*
420 Seminar in American Public Address and Criticism *(II, 3)*
430 Political Communication *(I, 3)*
431 Readers Theatre *(II, 3)*
433 Chamber Theatre *(II, 3)*
471, 472 Internship in Speech Communication *(I and II, 3 each)*
491, 492 Special Problems *(I and II, 1-3 each)*

Statistics Courses

Economics
576 Econometrics

Experimental Statistics
407 Introductory Biostatistics
408 or 409 Statistical Methods in Research I
412 Statistical Methods in Research II
413 Data Analysis
491 Directed Study in Experimental Statistics
492 Special Topics in Experimental Statistics
500 Nonparametric Statistical Methods
501 Analysis of Variance and Variance Components
502 Applied Regression Analysis
517 Small N Designs
520 Fundamentals of Sampling and Applications
532 Experimental Design
541 Multivariate Statistical Methods
542 Discrete Multivariate Methods
550 Ecological Statistics
591 Directed Study in Experimental Statistics
592 Special Topics in Experimental Statistics

Industrial Engineering
411 Engineering Statistics I
412 Engineering Statistics II
513 Statistical Quality Control
533 Advanced Statistical Methods for Research and Industry
634 Design and Analysis of Industrial Experiments
635 Response Surfaces and Evolutionary Operations

Management Science
581 Fundamental Business Statistics
601, 602 Advanced Business Statistics

Mathematics
451 Introduction to Probability and Statistics
452 Mathematical Statistics
456 Probability
550 Advanced Probability
551 Mathematical Statistics

Mechanical Engineering and Applied Mechanics
521 Reliability Analysis and Prediction

Psychology
510 Intermediate Quantitative Methods in Psychology
517 Small N Designs
610 Factor Analysis

Resource Economics
576 Econometrics

THE Courses
Theatre

420 Advanced Directing Practice *(I and II, 1-3)*
455 Advanced Costuming *(I and II, 1-3)*
465 Advanced Scene Design *(I and II, 1-3)*

URB Courses
Urban Affairs

498, 499 Urban Affairs Senior Seminar *(I and II, 3 each)*

Personnel

The Graduate School

Michel, Aloys A., *Dean*
Grubman, Stephen D., *Associate Dean*
Rose, Vincent C., *Associate Dean*
Turcotte, Robert B., *Assistant to the Dean*
Onosko, Joan M., *Executive Assistant*

The Graduate Council

Michel, Aloys A., *Chairman, Ex Officio*
Caldwell, Marjorie J., *Resource Development (1983)*
Cohen, Jerry, *Arts and Sciences (1985)*
Donnelly, Dorothy F., *Continuing Education (1984)*
Foster, Howard H., *Resource Development (1984)*
Hargraves, Paul E., *Oceanography (1985)*
Hirsch, Janet I., *Nursing (1985)*
Letcher, Stephen V., *Arts and Sciences (1983)*
McAllister, Joseph R., *Graduate Student (1983)*
Morin, Thomas D., *Arts and Sciences (1985)*
Narasimhan, Seetharama, *Business Administration (1985)*
Paruta, Anthony N., *Pharmacy (1983)*
Reiter, Ira H., *Acting President, Graduate Student Association (1983)*
Russell, Francis D., *Graduate Student (1983)*
Suzawa, Gilbert S., *Arts and Sciences (1984)*
Tufts, Donald W., *Engineering (1983)*
Willis, George H., *Human Science and Services (1983)*
Woods, L.B., *Library Science (1983)*
One student member (to be appointed by the Dean)

Academic Administrators

Newman, Frank, M.S., *President*
Ferrante, William R., Ph.D., *Vice President for Academic Affairs*
Knauss, John A., Ph.D., *Provost for Marine Affairs and Dean of the Graduate School of Oceanography*
Luzzi, Louis A., Ph.D., *Provost for Health Science Affairs and Dean of the College of Pharmacy*
Marks, Barry, Ph.D., *Dean of the College of Arts and Sciences*
Weeks, Richard R., Ph.D., *Provost for Public Policy and Dean of the College of Business Administration*
Goff, Robert H., M.S., *Acting Dean of the College of Engineering*
MacMillan, Robert W., Ph.D., *Dean of the College of Human Science and Services*
Tate, Barbara L., Ed.D., *Dean of the College of Nursing*
Donovan, Gerald A., Ph.D., *Dean of the College of Resource Development*
Strommer, Diane W., *Dean of the University College*
Schlessinger, Bernard S., Ph.D., *Dean of the Graduate Library School*
Pezzullo, Thomas R., Ph.D., *Acting Dean of the College of Continuing Education*
Sage, Nathaniel M., Jr., Ph.D., *Coordinator of Research*
Young, Arthur P., Ph.D., *Dean, University Libraries*

Board of Governors for Higher Education

Albert E. Carlotti, *Chairman*
Stephen M. Burns
Christopher Boyle *(Representative)*
Louise T. Kazanjian
Robert J. McKenna *(Senator)*
Blanche R. Murray
Henry J. Nardone
Mildred T. Nichols
Joseph W. Ress
Charles E. Shea
Prentice N. Witherspoon

Eleanor M. McMahon, *Commissioner of Higher Education*

Graduate Faculty

First date after title indicates appointment to present position; the second date, when the first fails to do so, indicates first appointment in the University.

Abell, Paul I., Professor of Chemistry, 1964, 1951.
Abushanab, Elie, Professor of Medicinal Chemistry, 1979, 1970.
Ageloff, Roy, Associate Professor of Management Science, 1977, 1972.
Albert, Alexa, Assistant Professor of Sociology/Anthropology, 1982.
Albert, Luke S., Professor of Botany, 1970, 1960.
Alexander, Lewis M., Professor of Geography, 1960.
Al-Kazily, Joan, Assistant Professor of Civil and Environmental Engineering, 1980.
Al-Kazily, M. Fadhil, Associate Professor of Ocean Engineering, 1981.

Allen, William R., Associate Professor of Management, 1977, 1973.
Alton, Aaron J., Professor of Marketing, 1961.
Anderson, Glen D., Assistant Professor of Resource Economics, 1981.
Anderson, Judith L., Professor of Speech Communication, 1982, 1970.
Arakelian, Paul G., Associate Professor of English, 1981, 1976.
Armstrong, Charles P., Professor of Management Science, 1981, 1971.
Aronian, Sona, Associate Professor of Russian, 1979, 1970.
August, Peter V., Assistant Professor of Zoology, 1981.
Barker, Walter L., Associate Professor of English, 1973, 1966.
Barnett, Harold, Associate Professor of Economics, 1979, 1970.
Barnett, Stanley M., Professor of Chemical Engineering, and Food Science and Technology, 1980, 1969.
Barron, Robert A., Assistant Professor of Mathematics, 1956.
Barton, Charles E., Assistant Research Professor of Oceanography, 1981.
Bass, Leonard J., Associate Professor of Computer Science, 1975, 1970.
Beaupre, Walter J., Professor of Speech Communication, 1968.
Beauregard, Raymond A., Professor of Mathematics, 1982, 1968.
Beckman, Carl H., Professor of Plant Pathology-Entomology and Botany, 1969, 1963.
Bell, Robert G., Professor of Biochemistry and Biophysics, 1979, 1971.
Bender, Michael L., Professor of Oceanography, 1982, 1972.
Benesch, Marlene, Assistant Professor of German, 1979.
Beretta, David, Chairman of the Board, Uniroyal Inc. (Retired), Executive in Residence, 1982.
Bergan, James G., Professor of Food Science and Nutrition, 1981, 1971.
Bergen, Daniel P., Professor of Library Science, 1975, 1970.
Berger, Stanley I., Professor of Psychology, 1965, 1963.
Berman, Allan, Professor of Psychology, 1976, 1968.
Bibb, Harold D., Associate Professor of Zoology, 1978, 1972.
Biller, Henry B., Professor of Psychology, 1975, 1970.
Birk, John R., Professor of Electrical Engineering, 1981, 1970.
Birmingham, Bruce K., Assistant Professor of Pharmacy, 1981, 1977.
Blackman, Nancy, Assistant Professor of Human Development, Counseling and Family Studies, 1977.
Blood, Linda L., Assistant Professor of Human Development, Counseling and Family Studies, 1968, 1965.
Bloomquist, Lorraine C., Associate Professor of Physical Education, 1977, 1967.
Bohnert, Lea M., Assistant Professor of Library Science, 1970.
Bond, Howard W., Professor of Medicinal Chemistry, Emeritus, 1976, 1966.
Bonner, Jill C., Professor of Physics, 1977, 1976.
Boothroyd, Jon C., Associate Professor of Geology, 1980, 1975.
Boulmetis, John, Assistant Professor of Education, 1982, 1977.
Briden, George, Assistant Professor of Finance and Insurance, 1982.
Briggs, Josiah M., Professor of History, 1975, 1969.
Brittingham, Barbara, Associate Professor of Education, 1977, 1973.
Bromley, James D., Extension Professor of Adult Education, 1975, 1954.
Brown, Burton G., Jr., Assistant Professor of History in the College of Continuing Education, 1971, 1967.
Brown, Christopher W., Professor of Chemistry, 1976, 1968.
Brown, George A., Professor of Mechanical Engineering and Applied Mechanics, 1966.
Brown, James H., Jr., Professor of Forest and Wildlife Management, 1980, 1958.
Brown, Phyllis R., Professor of Chemistry, 1980, 1973.
Brown, Phyllis T., Associate Professor of Nutrition, 1976, 1950.
Brown, Richard, Assistant Professor of Materials and Chemical Engineering, 1981.
Bryan, Anthony T., Associate Professor of History, 1974, 1969.
Budnick, Frank S., Professor of Management Science, 1982, 1971.
Bullock, Robert C., Associate Professor of Zoology, 1978, 1974.
Bumpus, Marguerite, Professor of Education, 1981, 1969.
Burke, Sally F., Assistant Professor of English in the College of Continuing Education, 1972, 1967.
Burkett, John P., Assistant Professor of Economics, 1981.
Cabelli, Victor J., Professor of Microbiology, 1979.
Cain, J. Allan, Professor of Geology, 1971, 1966.
Cairns, Scott N., Assistant Professor of Accounting, 1978.
Calabro, Hilda A., Associate Professor of Education, 1973, 1967.
Caldwell, Marjorie J., Associate Professor of Nutrition, 1980, 1972.
Caldwell, Roderick P., Associate Professor of Mathematics, 1979, 1962.
Callaghan, Dennis W., Associate Professor of Management, 1978, 1975.
Campbell, Josie P., Associate Professor of English in the College of Continuing Education, 1977, 1972.
Campbell, Norman A., Associate Dean of the College of Pharmacy, Professor of Pharmacy Administration, 1981, 1970.
Cane, Walter, Associate Professor of English in the College of Continuing Education, 1974, 1967.
Carlson, Severin C., Assistant Professor of Finance and Insurance, 1981.
Carney, Edward J., Professor of Computer Science and Statistics, 1974, 1967.
Caroselli, Nestor E., Professor of Botany, Emeritus, 1977, 1954.
Carpenter, Philip L., Professor of Microbiology, Emeritus, 1975, 1942.
Carrano, Frank M., Associate Professor of Computer Science, 1975, 1969.
Carroll, Leo, Professor of Sociology, 1982, 1972.
Casagrande, Richard A., Associate Professor of Plant Pathology-Entomology, 1982, 1976.
Cashdollar, Stanford E., Associate Professor of Classics, 1974, 1967.
Castro, Concepcion Y., R.N., Associate Professor of Nursing, 1977, 1969.
Ceo, Joseph S., Professor of Music, 1980, 1976.
Chang, Cheng-Jung, Assistant Professor of Civil Engineering, 1981.
Chang, Pei Wen, Professor of Animal and Veterinary Science, 1982, 1955.
Chang, Rosita P., Assistant Professor of Finance and Insurance, 1982.
Chartier, Armand B., Associate Professor of French, 1979, 1971.
Cheer, Clair J., Associate Professor of Chemistry, 1973, 1968.
Chichester, Clinton O., Professor of Food Science and Technology, 1970.
Chichester, Clinton O., III, Assistant Professor of Pharmacology and Toxicology, 1981.
Chipman, Robert K., Professor of Zoology, 1968.
Coates, Norman, Professor of Management, 1971.
Cobb, J. Stanley, Professor of Zoology, 1981, 1970.
Cohen, Greta L., Associate Professor of Physical Education, 1975, 1966.
Cohen, Jerry, Associate Professor of Psychology, 1980.
Cohen, Joel A., Professor of History, 1979, 1965.
Cohen, Paul S., Professor of Microbiology, 1975, 1966.
Cohen, Stewart, Professor of Human Development, Counseling and Family Studies, 1978, 1972.
Collyer, Charles E., Associate Professor of Psychology, 1981, 1976.
Comerford, Robert A., Associate Professor of Management, 1979, 1975.
Constantinides, Spiros M., Professor of Food Science and Technology and Biochemistry, 1974, 1968.
Cooper, Constance E., Assistant Professor of Human Development, Counseling and Family Studies, 1973.
Cornillon, Peter C., Assistant Research Professor of Oceanography and Ocean Engineering, 1981.
Cosgrove, Clifford, Professor of Food Science and Technology, 1974, 1953.

Costantino, Robert F., Professor of Zoology, 1978, 1972.
Costigliola, Frank, Associate Professor of History, 1978, 1972.
Croasdale, William, Professor of Education, 1982, 1965.
Crooker, Jeannette E., Associate Professor of Physical Education, 1967, 1955.
Cruickshank, Alexander M., Professor of Chemistry, 1969, 1953.
Crutchfield, Stephen, Assistant Professor of Resource Economics, 1980.
Cuddy, Lois, Assistant Professor of English, 1978.
Cuomo, Frank W., Associate Professor of Physics, 1975, 1959.
Dain, Joel A., Professor of Biochemistry, 1973, 1962.
Daly, James C., Associate Professor of Electrical Engineering, 1974, 1969.
Daniel, Charles E., Jr., Assistant Professor of History, 1968, 1967.
Dash, Gordon H., Jr., Associate Professor of Finance, 1979, 1974.
Datseris, Philip, Associate Professor of Mechanical Engineering and Applied Mechanics, 1981, 1977.
Datta, Dilip K., Professor of Mathematics, 1981, 1967.
DeFanti, David R., Professor of Pharmacology and Director of Crime Laboratory, 1973, 1961.
DeFeo, John J., Professor of Pharmacology, 1965, 1957.
Della Bitta, Albert J., Director of Research Center in Business and Economics and Professor of Marketing, 1981, 1971.
deLodzia, George, Professor of Management, 1975, 1970.
DelSanto, Frank, Associate Professor of Health and Physical Education, 1976, 1965.
DeLuise, Frank, Professor of Mechanical Engineering and Applied Mechanics, 1979, 1950.
Demitroff, John F., Registrar, 1975.
Dempsey, John D., Professor of Music, 1982, 1973.
Desjardins, J. Scott, Professor of Physics, 1976, 1960.
Dessimoz, Jean-Daniel, Assistant Professor of Electrical Engineering, 1980.
DeTorres, Olga H., Assistant Professor of Pharmacy, 1980.
Detrick, Robert S., Jr., Assistant Professor of Oceanography, 1979.
Dholakia, Nikhilesh, Associate Professor of Marketing, 1981.
Dholakia, Ruby Roy, Associate Professor of Marketing, 1981.
Dietz, Frank T., Professor of Physics, 1964, 1954.
Dionne, Roger E., Assistant Professor of Pharmacy, 1980.
Dirlam, Joel B., Professor of Economics and Resource Economics, Emeritus, 1964.
Donnelly, Dorothy F., Associate Professor of English, College of Continuing Education, 1979, 1965.
Donovan, Gerald A., Dean of the College of Resource Development, Director of the Agricultural Experiment Station, Director of the Cooperative Extension Service, and Professor of Animal Science, 1973.
Dornberg, Otto, Associate Professor of German, 1973, 1963.
Dowdell, Rodger B., Professor of Mechanical Engineering and Applied Mechanics, 1971, 1966.
Driels, Morris R., Associate Professor of Mechanical Engineering and Applied Mechanics, 1982.
Driver, Rodney D., Professor of Mathematics, 1974, 1969.
Duce, Robert A., Professor of Oceanography, Director, Center for Atmospheric Chemistry Studies, 1981, 1970.
Duff, Dale T., Associate Professor of Plant and Soil Science, 1975, 1967.
Dugas, James E., Assistant Professor of Pharmacy, 1980.
Durbin, Ann G., Associate Research Professor of Oceanography, 1982, 1980.
Durbin, Edward G., Associate Research Professor of Oceanography, 1982, 1980.
Durfee, Wayne K., Professor of Aquacultural Science and Pathology, 1978, 1951.
Dvorak, Wilfred P., Associate Professor of English in the College of Continuing Education, 1981, 1968.
Dymsza, Henry A., Professor of Food Science and Nutrition, 1970, 1966.
England, Ralph W., Jr., Professor of Sociology, 1964, 1960.
Englander, Larry, Associate Professor of Plant Pathology-Entomology, 1981, 1972.
Eshleman, Ruth E., Associate Professor of Nutrition, 1976.
Estrin, Joseph, Professor of Chemical Engineering, 1980.
Euler, William B., Assistant Professor of Chemistry, 1982.
Evans, David, Assistant Professor of Oceanography, 1978.
Farish, Donald J., Assistant Dean, College of Arts and Sciences and Adjunct Professor of Zoology, 1979.
Farstrup, Alan E., Associate Professor of Education, 1982, 1977.
Fasching, James L., Professor of Chemistry, 1979, 1969.
Feather, Roberta B., Associate Professor of Nursing, 1981, 1973.
Felbeck, George T., Jr., Professor of Soil Science, 1970, 1964.
Feld, Marcia, Associate Professor of Community Planning, 1975.
Ferrante, William R., Vice President for Academic Affairs and Professor of Mechanical Engineering and Applied Mechanics, 1972, 1956.
Findlay, James F., Jr., Professor of History, 1971.
Finizio, Norman J., Associate Professor of Mathematics, 1975, 1963.
Fisher, Harold W., Professor of Biophysics, Biochemistry, and Microbiology, 1968, 1963.
Fisher, John, J., Professor of Geology, 1979, 1964.
Fitzelle, George T., Professor of Human Development, Counseling and Family Studies, 1969, 1959.
Fitzgerald, John F., Jr., Associate Professor of Finance and Insurance, 1974, 1971.
FitzSimons, Ruth M., Professor of Speech Communication, 1972, 1969.
Florin, Paul Richard, Assistant Professor of Psychology, 1981.
Forcé, R. Ken, Assistant Professor of Chemistry, 1975.
Foresman, Kerry R., Assistant Professor of Zoology, 1979.
Foster, Howard H., Jr., Associate Professor of Community Planning, 1973, 1963.
Fox, Paul J., Associate Research Professor of Oceanography, 1981.
Fraleigh, John B., Professor of Mathematics, 1978, 1962.
Freeman, David H., Professor of Philosophy, 1962, 1957.
Freeman, David L. Associate Professor of Chemistry, 1980, 1976.
Frohlich, Reinhard K., Associate Professor of Geology, 1979, 1973.
Fuchs, Henry C., Associate Professor of Music, 1974, 1968.
Galloway, Thomas D., Director, Graduate Curriculum and Professor of Community Planning and Area Development, 1980.
Garber, Lester W., Assistant Professor of Industrial Engineering, 1980.
Gardner, Robert V., Professor of Sociology, 1976, 1949.
Garner, Grayce, R.N., Professor of Nursing, 1977.
Gates, John M., Professor of Resource Economics, 1982, 1969.
Gelles, Richard J., Professor of Sociology, 1982, 1973.
Gerber, Leonard E., Assistant Professor of Food Science, Technology, Nutrition and Dietetics, 1981.
Germain, Robert B., Assistant Professor of Psychology, 1981.
Gersuny, Carl, Professor of Sociology, 1977, 1968.
Ghonem, Hamouda, Associate Professor of Mechanical Engineering, 1981.
Gibbs, Geoffrey D., Associate Professor of Music, 1975, 1965.
Giebler, Albert C., Professor of Music, 1972, 1957.
Geortemiller, Clarence C., Jr., Professor of Zoology, 1977.
Goff, Robert H., Acting Dean of the College of Engineering and Associate Professor of Mechanical Engineering and Applied Mechanics, 1977, 1958.
Goldman, Mark I., Professor of English, 1970, 1958.
Goldsmith, Marian R., Assistant Professor of Zoology, 1980.
Golet, Francis C., Associate Professor of Forest and Wildlife Management, 1978, 1972.

Gonzalez, Richard D., Professor of Chemistry, 1977, 1965.
Goodman, Leon, Professor of Chemistry, 1970.
Goos, Roger D., Professor of Botany, 1972, 1970.
Goshdigian, Mabel B., Professor of Food Science, Technology, Nutrition and Dietetics, 1982, 1956.
Gough, Robert E., Associate Professor of Plant and Soil Science, 1981, 1976.
Gould, Walter P., Associate Professor of Forest and Wildlife Management, 1962, 1954.
Gray, Donald J., Assistant Professor of Chemical Engineering, 1980.
Gray, H. Glenn, Associate Professor of Animal and Veterinary Science, 1982, 1969.
Grebstein, Lawrence C., Professor of Psychology and Director, Psychological Consultation Center, 1975, 1964.
Greene, Douglas S., Associate Professor of Pharmacy, 1981, 1976.
Greene, Helen Finch, Associate Professor of Human Development, Counseling and Family Studies, 1973, 1971.
Greene, Jennifer C., Associate Professor of Education, 1982, 1977.
Griesemer, J. Lynn, Assistant Professor of Education, 1977.
Grigalunas, Thomas A., Associate Professor of Resource Economics, 1976, 1971.
Gross, Ira, Associate Professor of Psychology, 1974, 1967.
Grove, Edward A., Associate Professor of Mathematics, 1976, 1968.
Grubman, Stephen D., Associate Dean of the Graduate School and Associate Professor of Speech Communication, 1977, 1972.
Gullason, Thomas A., Professor of English, 1964, 1954.
Gunning, Thomas J., Associate Professor of Human Development, Counseling and Family Studies, 1973, 1961.
Gutchen, Robert M., Professor of History, 1976, 1964.
Haas, Robert S., Professor of Electrical and Ocean Engineering, 1974, 1948.
Hagist, Warren M., Professor of Mechanical Engineering and Applied Mechanics, 1977, 1951.
Hairston, Nelson G., Jr., Associate Professor of Zoology, 1981, 1977.
Hamilton, Charles T., Assistant Professor of Accounting, 1981.
Hammen, Carl S., Professor of Zoology, 1971, 1963.
Hammerschlag, Dieter, Professor of Urban Design, 1976, 1965.
Hanke, John W., Associate Professor of Philosophy, 1974, 1966.
Hanumara, R. Choudary, Associate Professor of Statistics, 1975, 1968.
Hargraves, Paul E., Associate Professor of Oceanography and Botany, 1976, 1968.
Harlin, Marilyn, Associate Professor of Botany, 1976, 1971.
Hartman, Karl A., Jr., Professor of Biophysics, 1976, 1967.
Hartt, Kenneth L., Associate Professor of Physics, 1966.
Hauke, Richard L., Professor of Botany, 1969, 1959.
Heard, John R., Professor of Music, 1982.
Heisler, Walter C., Professor of Education, 1978, 1964.
Hellman, Richard, Professor of Economcs, 1971, 1970.
Helms, Patricia A., Associate Professor of Textiles and Clothing, 1976, 1971.
Heltshe, James F., Associate Professor of Statistics, 1979, 1973.
Hemmerle, William J., Professor of Computer Science and Statistics, Emeritus, 1965.
Henderson, Jack B., Assistant Professor of Mechanical Engineering and Applied Mechanics, 1980.
Hendrix, Melvin K., Director of Black Studies, 1977.
Hennessey, Timothy M., Professor of Political Science, 1978, 1976.
Heppner, Frank H., Professor of Zoology, 1979, 1969.
Hermes, O. Don, Professor of Geology, 1978, 1968.
Higa, Misako, Assistant Professor of Textiles, Clothing and Related Art, 1977.
Hill, Robert B., Professor of Zoology, 1975, 1968.
Hills, Mathilda M., Associate Professor of English, 1977, 1970.
Hindle, Robinson J., Professor of Plant and Soil Science, 1976, 1962.
Hirsch, Janet I., R.N., Associate Professor of Nursing, 1971.
Holmsen, Andreas, Professor of Resource Economics, 1970, 1963.
Honhart, Michael W., Assistant Professor of History, 1972, 1971.
Horwitz, Stephen P., Assistant Professor of Education, 1975.
Hufnagel, Linda A., Associate Professor of Microbiology and Biophysics, 1979, 1973.
Hull, Richard J., Professor of Plant and Soil Science, 1979, 1969.
Humphrey, Alan B., Associate Professor of Management Science, 1978.
Hurley, Raymond M., Associate Professor of Speech Communication, 1982, 1976.
Husband, Thomas P., Assistant Professor of Forest and Wildlife Management, 1977.
Hutton, Lewis J., Professor of Hispanic Studies, 1973, 1966.
Hyland, Jean S., Associate Professor of French, 1968, 1964.
Hyland, Kerwin E., Jr., Professor of Zoology, 1966, 1953.
Jackson, Leland B., Professor of Electrical Engineering, 1979, 1974.
Jackson, Noel, Professor of Plant Pathology-Entomology, 1975, 1965.
Jacobs, Dorothy, Assistant Professor of English, 1968.
Jagschitz, John A., Associate Professor of Plant and Soil Science, 1975, 1956.
James, Charles F., Jr., Professor of Industrial Engineering, 1969, 1967.
Jarrett, Jeffrey E., Professor of Management Science, 1974, 1971.
Jeffries, Harry P., Professor of Oceanography, 1973, 1959.
Jenson, Patricia, Assistant Professor of Library Science, 1978.
Johnson, Eugene M., Professor of Marketing Management, 1975, 1971.
Johnson, Galen A., Associate Professor of Philosophy, 1980, 1976.
Juda, Lawrence, Associate Professor of Geography and Marine Affairs, 1979, 1977.
Kahn, Leonard N., Assistant Professor of Physics, 1980.
Kalymun, Mary, Assistant Professor of Education, 1974.
Kass-Simon, Gabriele, Associate Professor of Zoology, 1978, 1973.
Kaufman, Charles, Associate Professor of Physics, 1973, 1964.
Kay, Steven M., Assistant Professor of Electrical Engineering, 1980.
Kelley, Marc A., Assistant Professor of Sociology and Anthropology, 1981.
Kelley, Robert B., Professor of Electrical Engineering, 1981, 1966.
Kellogg, Theodore M., Associate Professor of Education, 1976, 1970.
Kelly, Patricia M., Professor of Home Economics Education, 1975, 1969.
Kelly, William, Professor of Education, 1982, 1966.
Kelly, William E., Professor of Civil and Environmental Engineering, 1981, 1972.
Kennett, James P., Professor of Oceanography, 1974, 1970.
Kent, George E., Professor of Music, 1980, 1969.
Kester, Dana R., Professor of Oceanography, 1976, 1969.
Killilea, Alfred G., Professor of Political Science, 1980, 1969.
Killingbeck, Keith T., Assistant Professor of Botany, 1979.
Kim, Chai, Professor of Management Science, 1981.
Kim, Chong Sun, Professor of History, 1979, 1965.
Kim, Hesook Susie (Kang), R.N., Professor of Nursing, 1979, 1973.
Kim, Thomas Joon-Mock, Professor of Mechanical Engineering and Applied Mechanics, 1979, 1968.
Kim, Yong Choon, Professor of Philosophy, 1979, 1971.
Kirschenbaum, Louis J., Associate Professor of Chemistry, 1976, 1970.
Kirwan, Donald F., Co-Director of Office of Energy Education and Professor of Physics, 1982, 1967.
Klein, Maurice N., Professor of History, 1973, 1964.
Knauss, John A., Provost for Marine Affairs, Dean of the Graduate School of Oceanography and Professor of Oceanography, 1969, 1962.

Knickle, Harold N., Professor of Chemical Engineering, 1982, 1969.
Koske, Richard E., Assistant Professor of Botany, 1978.
Kowalski, James G., Associate Professor of Philosophy, 1978, 1971.
Kowalski, Tadeusz, Professor of Ocean Engineering, 1976, 1969.
Koza, Russell C., Professor of Management Science, 1979, 1977.
Kraus, Douglas L., Professor of Chemistry, Emeritus, 1971, 1947.
Krausse, Gerald H., Assistant Professor of Geography, 1975, 1973.
Krueger, William H., Associate Professor of Zoology, 1973, 1964.
Krul, William R., Associate Professor of Plant and Soil Science, 1977.
Kulberg, Janet, Associate Professor of Psychology, 1974.
Kuhn, Ira A., Associate Professor of French, 1977, 1967.
Kumekawa, Glenn R., Director of Intergovernmental Policy Analysis Program and Adjunct Associate Professor of Community Planning, 1980, 1969.
Kunz, Don R., Associate Professor of English, 1982, 1968.
Kupa, John J., Associate Professor of Forestry, 1969, 1963.
Ladas, Gerasimos, Professor of Mathematics, 1975, 1969.
Laine, Edward P., Assistant Research Professor of Oceanography, 1980.
Lamagna, Edmund A., Associate Professor of Computer Science, 1982, 1976.
Lampe, Harlan C., Professor of Resource Economics, 1969, 1968.
Langdon, Mary L., Assistant Professor of Music, 1981.
Lardaro, Leonard P., Assistant Professor of Economics, 1981.
Larmie, Walter E., Professor of Plant and Soil Science, 1973, 1949.
Larson, Roger L., Professor of Oceanography, 1980.
Lasswell, William L., Assistant Professor of Pharmacognosy, 1978.
Lausier, Joan M., Associate Professor of Pharmacy, 1977, 1971.
Laux, David C., Associate Professor of Microbiology, 1978, 1973.
Laviano, Andrew, Associate Professor of Business Law, 1982, 1978.
Lawing, William D., Jr., Associate Professor of Industrial Engineering and Experimental Statistics, 1969.
LeBlanc, Lester R., Professor of Ocean Engineering, 1980, 1971.
Lebrun, Roger A., Assistant Professor of Plant Pathology-Entomology, 1977.
Leduc, Edgar C., Professor of Political Science, 1976, 1969.
Lee, Chong-Min, Associate Professor of Food Science, Technology, Nutrition and Dietetics, 1982, 1980.
Lee, Tung-Ching, Professor of Food Science, Technology, Nutrition and Dietetics, 1979, 1972.
Lengyel, Gabriel, Professor of Electrical Engineering, 1971, 1966.
Leo, John R., Assistant Professor of English in the College of Continuing Education, 1973.
Lepper, Robert, Jr., Professor of Botany, Emeritus, 1977, 1948.
Lessmann, Richard C., Associate Professor of Mechanical Engineering, 1975, 1969.
Letcher, Stephen V., Professor of Physics, 1975, 1963.
Lewis, James T., Professor of Mathematics, 1981, 1969.
Lindgren, Allen G., Professor of Electrical Engineering, 1970, 1964.
Liu, Pan-Tai, Professor of Mathematics, 1979, 1968.
Logan, Patrick A., Assistant Professor of Plant Pathology-Entomology, 1980, 1977.
Long, John V., Jr., Professor of Education, 1979, 1971.
Looney, Daniel J., Jr., Assistant Professor of Accounting, 1965, 1961.
Lord, Blair M., Associate Professor of Finance and Insurance, 1981, 1976.
Lott, Albert J., Professor of Psychology, 1969.
Lott, Bernice, Professor of Psychology and Women's Studies, 1975, 1970.
Loy, James D., Associate Professor of Anthropology, 1978, 1974.
Luzzi, Louis A., Provost for Health Science Affairs, Dean of the College of Pharmacy and Professor of Pharmacy, 1981.
Lynch, Robert N., Assistant Professor of Anthropology, 1971, 1970.
Lysonski, Steven, J., Associate Professor of Marketing, 1980.
MacIntyre, Ferren, Research Professor of Oceanography, 1980, 1977.
MacLaine, Allan H., Professor of English, 1962.
MacMillan, Robert W., Dean of the College of Human Science and Services and Professor of Education, 1979, 1966.
Malik, Surendra, Professor of Physics, 1974, 1962.
Malina, Marilyn J., Associate Professor of English, 1977, 1967.
Mandell, Barbara, Associate Professor of Physical Education, 1968, 1960.
Manfredi, Claire M., R.N., Assistant Professor of Nursing, 1977.
Manfredi, Thomas G., Associate Professor of Physical Education, 1982.
Mangiameli, Paul M., Assistant Professor of Management Science, 1977.
Manteiga, Robert, Associate Professor of Hispanic Studies, 1981, 1976.
Marcus, Alan S., Associate Professor of Civil and Environmental Engineering, 1977, 1969.
Mardix, Shmuel, Professor of Electrical Engineering, 1978, 1970.
Marks, Barry A., Dean of the College of Arts and Sciences and Professor of English, 1974.
Marshall, James M., Associate Professor of English, 1968, 1965.
Marshall, Nelson, Professor of Oceanography and Marine Affairs, 1972, 1959.
Marti, Bruce, Instructor in Geography and Marine Affairs, 1980.
Martin, Celest A., Assistant Professor of English, 1979.
Martin, Spencer J., Professor of Accounting, 1980, 1970.
Massey, M. Dorothy, Professor of Physical Education, 1960, 1945.
Matejski, Myrtle S., R.N., Assistant Dean and Associate Professor of Nursing, 1981.
Mathews, Francis X., Professor of English, 1977, 1967.
Matoney, Joseph P., Jr., Associate Professor of Accounting, 1973.
Mattea, Edward J., Associate Professor of Pharmacy, 1980, 1974.
Maynard, Peter E., Professor of Human Development, Counseling and Family Studies, 1981, 1971.
McCabe, Thomas H., Associate Professor of English, 1974, 1965.
McCreight, Donald E., Professor of Agricultural Education, 1980, 1970.
McEwen, Everett E., Associate Professor of Civil Engineering, 1967.
McGuire, John J., Professor of Plant and Soil Science, 1977, 1962.
McGuire, Marion L., Director, Graduate Reading Center, and Professor of Education, 1976, 1965.
McKinney, William L., Associate Professor of Education, 1977, 1972.
McLeavey, Dennis W., Professor of Management Science, 1982, 1976.
McMaster, Robert L., Professor of Oceanography, 1969, 1953.
McNab, Gregory R., Jr., Associate Professor of Portuguese, 1978, 1971.
Mead, Arthur C., Assistant Professor of Economics, 1978, 1976.
Meade, Thomas L., Professor of Aquacultural Science and Pathology, 1975, 1968.
Mensel, William L., Jr., Assistant Professor of English, 1973, 1969.
Merenda, Peter F., Professor of Psychology and Statistics, 1965, 1960.
Metz, William D., Professor of History, 1960, 1945.
Michel, Aloys A., Dean of the Graduate School and Professor of Geography and Regional Planning, 1973, 1966.
Middleton, David, Professor of Electrical Engineering, 1970, 1966.
Middleton, Foster H., Professor of Ocean Engineering, 1961, 1959.
Milburn, Josephine F., Professor of Political Science, 1977, 1970.
Miller, Jordan Y., Professor of English, 1969.
Mitra, Shashanka S., Professor of Electrical Engineering, 1965.
Mojena, Richard, Professor of Management Science, 1981, 1971.
Montgomery, John T., Associate Professor of Mathematics, 1977, 1973.
Moore, Theodore C., Professor of Oceanography, 1978, 1975.

Morello, Joseph G., Associate Professor of French, 1979, 1968.
Morin, Thomas D., Associate Professor of Hispanic Studies, 1980, 1975.
Morton, David S., Assistant Professor of Education, 1975.
Mottinger, John P., Associate Professor of Botany and Zoology, 1974, 1968.
Motycka, Arthur, Professor of Music, 1975, 1972.
Mueller, Walter C., Professor of Plant Pathology-Entomology, 1974, 1961.
Murphy, Clare M., Associate Professor of English, 1973, 1964.
Murphy, Karen E., Assistant Professor of Political Science, 1977.
Nacci, Vito A., Professor of Civil and Ocean Engineering, 1968, 1949.
Nagel, Wilma I., Associate Professor of Education, 1974, 1968.
Nally, Thomas P., Professor of Education, 1962, 1956.
Napora, Theodore A., Assistant Dean of the Graduate School of Oceanography and Associate Professor of Oceanography, 1972, 1958.
Nash, Charles D., Jr., Professor of Mechanical Engineering and Applied Mechanics, 1964.
Narasimhan, Seetharama, Associate Professor of Management Science, 1979.
Nason, Robert W., Professor of Marketing, 1980, 1973.
Navascuès, Michael, Associate Professor of Hispanic Studies, 1975, 1968.
Nedwidek, Raymond A., Professor of Physical Education, 1976, 1965.
Nelson, David R., Assistant Professor of Microbiology, 1982.
Nelson, Richard G., Associate Professor of Education, 1978, 1972.
Nelson, Wilfred H., Professor of Chemistry, 1977, 1964.
Neuse, Richard T., Professor of English, 1970, 1956.
Newman, Frank, President of the University, 1974.
Nichols, Edward, Professor of Industrial Engineering, 1960, 1959.
Niedzwecki, John M., Associate Professor of Ocean Engineering, 1982.
Nippo, Mum M., Associate Professor of Animal and Veterinary Science, and Food Science Technology, Nutrition and Dietetics, 1982, 1972.
Nixon, Dennis W., Assistant Professor of Marine Affairs and Coordinator, Marine Affairs Program, 1978, 1976.
Nixon, Scott W., Professor of Oceanography, 1980, 1970.
Northby, Jan A., Professor of Physics, 1979, 1970.
Nunes, Anthony C., Professor of Physics, 1982, 1976.
O'Donnell, Leo E., Associate Professor of Physical Education, 1976, 1972.
Ohley, William J., Associate Professor of Electrical Engineering, 1982, 1976.

Olney, Charles E., Professor of Food Science and Nutrition, 1968, 1948.
Opaluch, James J., Assistant Professor of Resource Economics, 1979.
Osborne, George E., Professor of Pharmacy, 1957.
Overton, Craig E., Professor of Management, 1981, 1969.
Oviatt, Candace A., Research Professor of Oceanography, 1982, 1970.
Pakula, Lewis I., Associate Professor of Mathematics, 1978, 1973.
Palm, William J., Associate Professor of Mechanical Engineering and Applied Mechanics, 1976, 1970.
Palmatier, Elmer A., Professor of Botany, 1959, 1942.
Panzica, Raymond P., Associate Professor of Medicinal Chemistry, 1980, 1976.
Papadakis, John S., Professor of Mathematics, 1982, 1971.
Paruta, Anthony N., Professor of Pharmacy, 1971, 1966.
Pascale, Alfred C., Associate Professor of Human Development, Counseling and Family Studies, 1967, 1965.
Pearlman, Daniel D., Professor of English, 1980.
Penhallow, William S., Associate Professor of Physics, 1973, 1959.
Peters, Calvin B., Assistant Professor of Sociology, 1978.
Petersen, Harold, Jr., Professor of Chemistry, 1979, 1967.
Peterson, John F., Jr., Professor of Philosophy, 1979, 1964.
Petrie, Paul J., Professor of English, 1969, 1959.
Petrocelli, Americo W., Vice President for Business and Finance and Adjunct Professor of Chemistry, 1979, 1977.
Pezzullo, Thomas R., Acting Dean of the College of Continuing Education and Professor of Education, 1982, 1970.
Pickart, Stanley J., Professor of Physics, 1974.
Pilson, Michael E., Professor of Oceanography, 1978, 1966.
Poggie, John J., Jr., Professor of Anthropology, 1975, 1969.
Polidoro, J., Richard, Associate Professor of Physical Education, Health, and Recreation, 1975, 1969.
Polk, Charles, Professor of Electrical Engineering, 1959.
Pollart, Gene J., Associate Professor of Music, 1976.
Pollnac, Richard B., Professor of Anthropology, 1982, 1973.
Poon, Calvin Po-Chuen, Professor of Environmental Engineering, 1975, 1965.
Porter, Lambert C., Professor of French and Linguistics, Emeritus, 1964, 1961.
Potter, Nancy A., Professor of English, 1963, 1947.
Poularikas, Alexander D., Professor of Electrical Engineering, 1976, 1965.
Poulsen, Roy G., Professor of Finance, 1967, 1948.
Pratt, David M., Professor of Oceanography, Emeritus, 1979, 1949.
Prochaska, James O., Professor of Psychology, 1977, 1969.
Purnell, Richard F., Professor of Education, 1977, 1970.
Purvis, John L., Professor of Biochemistry, 1968, 1961.
Quina-Holland, Kathryn, Associate Professor of Psychology, 1982, 1978.
Quinn, James G., Professor of Oceanography, 1978, 1968.
Radhakrishnan, Thirumalaiswan, Assistant Professor of Industrial Engineering, 1981.
Rae, Gwenneth, Professor of Human Development, Counseling and Family Studies, 1982, 1973.
Rahn, Kenneth A., Associate Research Professor of Oceanography, 1980.

Rajan, Roger G., Associate Professor of Computer Science, 1981.
Ramsay, Glenworth A., Associate Professor of Economics, 1978, 1973.
Rand, Arthur G., Jr., Professor of Food Science and Technology, 1975, 1963.
Rankin, W. Donald, Professor of Music, 1979, 1963.
Rapport, Mark D., Assistant Professor of Psychology, 1981.
Rayack, Elton, Professor of Economics, 1966, 1958.
Reaves, R.B., Jr., Associate Professor of English, 1975, 1968.
Rebele, James, Assistant Professor of Accounting, 1982.
Recksiek, Conrad W., Associate Professor of Fisheries and Marine Technology, 1980.
Reilly, Mary E., Associate Professor of Sociology and Women's Studies, 1978, 1973.
Rhodes, Christopher T., Professor of Pharmacy, 1975.
Risch, Ernest H., Assistant Professor of Textiles, Clothing and Related Art, 1981.
Rockett, Thomas J., Professor of Materials and Chemical Engineering, 1982, 1971.
Rodgers, Robert L., Assistant Professor of Pharmacology and Toxicology, 1981.
Rogers, Kenneth H., Associate Professor of French and Linguistics, 1976, 1968.
Rogers, Warren F., Professor of Management Science, 1975.
Rorholm, Niels, Coordinator of Sea Grant Programs and Professor of Resource Economics, 1971, 1954.
Rose, Vincent C., Associate Dean of the Graduate School and Associate Professor of Nuclear and Ocean Engineering, 1973, 1963.
Rosen, William M., Professor of Chemistry, 1982, 1970.
Rosengren, William R., Professor of Sociology, 1968, 1967.
Rosie, Douglas M., Assistant Vice President for Academic Affairs and Professor of Chemistry, 1972, 1958.
Rossby, Hans T., Professor of Oceanography, 1975.
Rothschild, H. Dorothy, Professor of French, 1974, 1962.
Rothstein, Lawrence, Associate Professor of Political Science, 1979, 1976.
Roughton, Richard A., Associate Professor of History, 1982, 1968.
Roxin, Emilio O., Professor of Mathematics, 1967.
Russo, Francis X., Professor of Education, 1973, 1966.
Sadasiv, Angaraih G., Professor of Electrical Engineering, 1976, 1969.
Sadd, Martin H., Associate Professor of Mechanical Engineering and Applied Mechanics, 1979.
Sage, Nathaniel M., Jr., Coordinator of Research and Lecturer in Geology, 1968.
Saila, Saul B., Professor of Oceanography and Zoology, 1967, 1956.
Salomon, Milton, Professor of Food and Resource Chemistry, Emeritus, 1962, 1939.
St. Pierre, E. Kent, Assistant Professor of Accounting, 1979.
Salvatore, Lucy V., Associate Professor of Library Science, 1974, 1964.
Sastry, Akella N., Professor of Oceanography, 1977, 1966.
Schaffran, Jerome A., Associate Professor of Human Development, Counseling and Family Studies, 1977, 1971.
Scharf, Louis L., Professor of Electrical Engineering, 1982.
Schilling, Jean-Guy, Professor of Oceanography, 1974, 1966.
Schlessinger, Bernard S., Dean, Graduate Library School and Professor of Library Science, 1977.
Schmidt, Charles T., Jr., Professor of Industrial Relations, 1973, 1968.
Schneider, Stewart P., Associate Professor of Library Science, 1974, 1964.
Scholl, Richard W., Assistant Professor of Management, 1979.
Schonbek, Maria E., Assistant Professor of Mathematics, 1980.
Schoonover, Eric T., Associate Professor of English, 1980, 1962.
Schroeder, Karen A., Assistant Professor of Human Development, Counseling and Family Studies, 1972, 1968.
Schurman, Bernard, Professor of Economics, Emeritus, 1959, 1948.
Schwartz-Barcott, Donna, R.N., Associate Professor of Nursing, 1979, 1975.
Schwartzman, Sol, Associate Professor of Mathematics, 1969.
Schwarz, Stephen D., Professor of Philosophy, 1979, 1963.
Schwarzbach, Henry R., Associate Professor of Accounting, 1980, 1976.
Schwegler, Robert A., Assistant Professor of English, 1978.
Scruggs, Barbara J., Assistant Professor of Textiles, Clothing and Related Art, 1980.
Seigel, Jules P., Professor of English, 1976, 1965.
Seleen, Diane Rae, Associate Professor of Physical Education, 1982, 1971.
Seymour, Daniel Thomas, Assistant Professor of Marketing, 1982.
Shao, David M., Associate Professor of Industrial Engineering, 1976, 1969.
Shaw, Richard J., Associate Professor of Plant and Soil Science, 1976, 1970.
Shea, Gail A., Assistant Professor of Sociology and Anthropology and Women's Studies, 1975.
Sheath, Robert G., Associate Professor of Botany, 1982, 1978.
Sheets, Herman E., Professor of Ocean Engineering, Emeritus, 1966.
Shen, Randolph F., Professor of Management Science, 1977, 1966.
Sherman, Arthur L., Associate Professor of Physical Education, 1976, 1959.
Shilling, George D., Professor of Chemical Engineering, 1964, 1952.
Shimizu, Yuzuru, Professor of Pharmacognosy, 1977, 1969.
Shisha, Oved, Professor of Mathematics, 1976, 1974.
Shontz, David F., Professor of Adult and Extension Education, 1974, 1964.
Shoop, C. Robert, Professor of Zoology, 1974, 1969.
Shukla, Arun, Assistant Professor of Mechanical Engineering and Applied Mechanics, 1981.
Sieburth, John M., Professor of Oceanography and Microbiology, 1966, 1960.
Sigurdsson, Haraldur, Professor of Oceanography, 1980, 1974.
Silva, Armand J., Professor of Ocean and Civil Engineering, 1976.
Silverstein, Albert, Professor of Psychology, 1974, 1963.
Silvestri, Gino, Assistant Professor of History, 1969, 1965.
Simpson, Kenneth L., Professor of Food Science and Nutrition, 1972, 1964.
Sine, Robert C., Professor of Mathematics, 1977, 1971.
Singer, Jay, Assistant Professor of Speech Communication, 1977.
Sink, Clay V., Professor of Business Education and Administrative Services, 1982, 1969.
Sisco, Richard C., Associate Professor of Business Law, 1981, 1976.
Skogley, Conrad Richard, Professor of Plant and Soil Science, 1970, 1960.
Smart, Mollie S., Professor of Child Development and Family Relations, Emerita, 1973, 1954.
Smart, Russell, C., Professor of Child Development and Family Relations, Emeritus, 1976, 1953.
Smayda, Theodore J., Professor of Oceanography and Botany, 1970, 1959.
Smith, Charles I., Professor of Medicinal Chemistry, 1974, 1960.
Smith, Kathleen F., Associate Professor of Business Education and Office Administration, 1962, 1955.
Smith, Lewis T., Station Statistician and Professor of Aquacultural Science and Pathology, 1971, 1964.
Smith, Nelson F., Professor of Psychology, 1975, 1965.
Smith, Warren D., Professor of English, Emeritus, 1955, 1942.
Soh, Jin W., Associate Professor of Computer Science, 1981.
Sonstroem, Robert J., Professor of Physical Education, Health and Recreation, 1980, 1969.
Sorlien, Robert P., Professor of English, 1968, 1946.
Spaulding, Irving A., Professor of Resource Economics and Rural Sociology, 1960, 1949.
Spaulding, Malcolm L., Associate Professor of Ocean Engineering, 1977, 1973.
Spence, Donald L., Director, Program in Gerontology and Professor of Human Development, Counseling and Family Studies, 1982, 1973.
Spence, John E., Professor of Electrical Engineering, 1974, 1962.

Sperry, Jay F., Assistant Professor of Microbiology, 1977.
Starkey, James L., Associate Professor of Economics, 1975, 1967.
Stauffer, Kenneth R., Assistant Professor of Food Science, 1979.
Steeves, Edna L., Professor of English, Emerita, 1974, 1967.
Stein, Arthur, Professor of Political Science, 1974, 1965.
Stepanishen, Peter R., Professor of Ocean Engineering, 1982, 1974.
Stern, Melvin E., Professor of Oceanography, 1964.
Stevenson, John F., Associate Professor of English, 1980, 1973.
Stinebeck, David C., Professor of English, 1982, 1977.
Strom, Sharon H., Professor of History and Women's Studies, 1982, 1969.
Strommer, Diane W., Dean of the University College and Adjunct Associate Professor of English, 1981, 1980.
Sullivan, Richard E., Assistant Professor of Education, 1971.
Sullivan, William Michael, Assistant Professor of Plant and Soil Science, 1981.
Surprenant, Thomas T., Assistant Professor of Library Science, 1978.
Suryanarayan, E. Ramnath, Professor of Mathematics, 1973, 1960.
Sussman, Donald L., Associate Professor of Civil Engineering, 1976, 1967.
Sutinen, Jon G., Associate Professor of Resource Economics, 1981, 1973.
Suzawa, Gilbert S., Associate Professor of Economics, 1981, 1971.
Swan, M. Beverly, Assistant Vice President for Academic Affairs, Director of the College Writing Program and Associate Professor of English, 1981, 1974.
Swanson, Elizabeth, Assistant Professor of Botany, 1978.
Swift, Elijah V., Professor of Oceanography and Botany, 1980, 1969.
Swonger, Alvin K., Associate Professor of Pharmacology and Toxicology, 1977, 1971.
Tate, Barbara L., R.N., Dean of the College of Nursing and Professor of Nursing, 1969.
Taubman, Albert H., Associate Professor of Pharmacy Administration, 1982.
Test, Frederick L., Professor of Mechanical Engineering and Applied Mechanics, 1962, 1949.
Thurston, Gary Associate Professor of History, 1976, 1966.
Toloudis, Constantin, Associate Professor of French, 1977, 1966.
Towers, Tom H., Professor of English in the College of Continuing Education, 1979, 1971.
Travisano, Richard V., Assistant Professor of Sociology, 1973, 1969.
Traxler, Richard W., Professor of Plant Pathology-Entomology and Microbiology, 1971.
Tremblay, George C., Professor of Biochemistry, 1975, 1966.
Trubiano, Mario F., Assistant Professor of Spanish, 1979.
Tryon, Jonathan S., Associate Professor of Library Science, 1977, 1969.
Tufts, Donald W., Professor of Electrical Engineering, 1967.
Turcotte, Joseph G., Professor of Medicinal Chemistry, 1977, 1967.
Turnbaugh, William A., Associate Professor of Anthropology, 1978, 1974.
Tutt, Ralph M., Associate Professor of English, 1971, 1964.
Tyler, Gerry R., Assistant Professor of Political Science, 1980, 1966.
Tynan, Eugene J., Associate Professor of Geology, 1968, 1959.
Tyrrell, Timothy J., Assistant Professor of Resource Economics, 1978.
Urish, Daniel W., Associate Professor of Civil and Environmental Engineering, 1981, 1978.
Valentino, Domenic, Associate Professor of Psychology, 1978, 1973.
Vangermeersch, Richard, Professor of Accounting, 1979, 1971.
Velicer, Wayne F., Professor of Psychology, 1982, 1973.
Verma, Ghasi Ram, Professor of Mathematics, 1980, 1964.
Viglionese, Paschal, Associate Professor of Italian, 1976, 1964.
Vittimberga, Bruno M., Professor of Chemistry, 1971, 1961.
Visburgh, William T., Professor of Psychology and Director, School Psychology Program, 1973, 1965.
Votta, Ferdinand, Jr., Professor of Chemical Engineering, Emeritus, 1974, 1946.
Wakefield, Robert C., Professor of Plant and Soil Science, 1965, 1954.
Wallace, William H., Associate Extension Professor of Resource Economics, 1961, 1953.
Warren, David D., Professor of Political Science, 1967, 1953.
Waters, Harold A., Professor of French, 1969, 1962.
Watts, D. Randolph, Associate Professor of Oceanography, 1980, 1974.
Weaver, Thomas F., Associate Professor of Resource Economics, 1977, 1971.
Weber, Stanley S., Associate Professor of Pharmacy, 1982, 1978.
Weeden, Patricia J., Associate Professor of Textiles, Clothing and Related Art, 1978, 1961.
Weeks, Richard R., Provost for Public Policy, Public Service and Management, Dean of the College of Business Administration, and Professor of Marketing, 1970.
Weiderman, Nelson H., Associate Professor of Computer Science and Director of the Academic Computer Center, 1977, 1971.
Weisberg, Robert F., Assistant Professor of Environmental Health Sciences, 1981, 1979.
Weisbord, Robert G., Professor of History, 1973, 1966.
Welters, Linda M., Assistant Professor of Textiles, Clothing and Related Art, 1981.
Wenisch, Fritz, Professor of Philosophy, 1980, 1971.
West, Niels, Associate Professor of Geography and Marine Affairs, 1976.
White, Frank M., Professor of Mechanical and Ocean Engineering, 1967, 1964.
White, Sidney H., Professor of English in the College of Continuing Education, 1973, 1966.
Wilde, Charles E., Jr., Professor of Zoology, 1975.
Willis, George H., Professor of Education, 1981, 1971.
Willoughby, Alan, Professor of Psychology, 1974, 1968.
Wilson, Mason P., Jr., Professor of Mechanical Engineering and Applied Mechanics, and Director of University Center for Energy Studies, 1976, 1968.
Wimbush, Mark, Associate Professor of Oceanography, 1977.
Winn, Howard E., Professor of Oceanography and Zoology, 1965.
Wish, John, Associate Dean of the College of Business Administration, Director of MBA Program, and Professor of Marketing, 1979.
Wishner, Karen, Assistant Professor of Oceanography, 1980.
Wolke, Richard E., Professor of Aquacultural Science and Pathology, 1981, 1970.
Wood, Norris P., Professor of Microbiology, 1972, 1963.
Wood, Stephen B., Professor of Political Science, 1970, 1967.
Woods, Lemuel B., Associate Professor of Library Science, 1980, 1977.
Worthen, Leonard R., Director of Environ-Mental Health Science and Professor of Pharmacognosy, 1970, 1957.
Wright, Raymond M., Assistant Professor of Civil Engineering, 1981.
Wright, William R., Associate Professor of Plant and Soil Science, 1978, 1972.
Wry, Ora E., Assistant Professor of Music, 1978.
Yang, Sze Cheng, Assistant Professor of Chemistry, 1980.
Yates, Vance J., Professor of Animal and Veterinary Science, 1955, 1949.
Young, Arthur P., Dean of University Libraries and Professor, Library, 1981.
Young, William, Professor of Philosophy, 1973, 1960.
Youngken, Heber W., Jr., Provost for Health Science Affairs, Dean of the College of Pharmacy, and Professor of Pharmacognosy, Emeritus, 1969, 1957.
Zeyl, Donald J., Associate Professor of Philosophy, 1977, 1971.
Zucker, Norman L., Professor of Political Science, 1969, 1966.
Zweig, Franklin, Professor of Human Development, Counseling and Family Studies, 1980.

Adjunct Faculty

Andersen, Peder, Adjunct Professor of Resource Economics, 1981.
Anderson, Donald M., Adjunct Professor of Oceanography, 1981.
Apostal, Michael C., Adjunct Associate Professor of Civil and Environmental Engineering, 1978.
Arnold, Charles, Adjunct Associate Professor of Computer Science, 1981.
Banerjee, Pranab K., Adjunct Associate Professor of Electrical Engineering, 1980.
Beardsley, Robert C., Adjunct Professor of Oceanography, 1982.
Beck, Allan D., Adjunct Professor of Food Science, Technology, Nutrition and Dietetics, 1982.
Bliss, Dorothy E., Adjunct Professor of Zoology, 1980.
Bordelon, Derrill, Adjunct Professor of Mathematics, 1978.
Brown, Bradley, Adjunct Professor of Oceanography, 1981.
Carlson, Nancy, Adjunct Associate Professor of Psychology, 1980.
Chamberlin, J. Lockwood, Adjunct Professor of Oceanography, 1982.
Coduri, Richard J., Jr., Adjunct Associate Professor of Food Science, Technology, Nutrition and Dietetics, 1981, 1972.
Cook, David O., Adjunct Professor of Oceanography, 1981.
Dexter, Daniel L., Adjunct Assistant Professor of Pharmacology and Toxicology, 1979.
Dimeglio, A. Francis, Adjunct Associate Professor of Nuclear Engineering, 1965.
DiNapoli, Frederick R., Adjunct Associate Professor of Mathematics, 1979, 1970.
Dougall, Donald K., Adjunct Professor of Botany, 1975.
Douglas, William H., Adjunct Associate Professor of Biochemistry, 1975.
Edwards, Robert L., Adjunct Professor of Oceanography, 1981.
Elmgren, S. Ragnar, Adjunct Professor of Oceanography, 1978.
Fielding, Stuart, Adjunct Associate Professor of Pharmacology and Toxicology, 1980.
Ford, Donald L., Adjunct Professor of Health Sciences, 1979.
Fuller, George C., Adjunct Professor of Pharmacology and Toxicology, 1980.
Gentile, John H., Adjunct Associate Professor of Aquacultural Science and Pathology, 1982.
Giambalvo, Cecilia T., Adjunct Assistant Professor of Pharmacology and Toxicology, 1979.
Gibbs, Robert H., Adjunct Professor of Zoology, 1971.
Hachadorian, Charles, Jr., Adjunct Assistant Professor of Pharmacy Administration, 1981.
Hammond, Rupert P., Adjunct Assistant Professor of Pharmacology and Toxicology, 1982.
Heath, Ross G., Adjunct Professor of Oceanography, 1978.
Hennemuth, Richard C., Adjunct Professor of Oceanography, 1981.
Howe, Jeffrey L., Adjunct Assistant Professor of Food Science and Nutrition, 1979.
Imbrie, John, Adjunct Professor of Oceanography, 1976.
Jackim, Eugene, Adjunct Assistant Professor of Pharmacology and Toxicology, 1980.
Kaplan, Arthur, Adjunct Professor of Plant Pathology-Entomology, 1969.
Kaplan, Stephen R., M.D., Adjunct Associate Professor of Pharmacology and Toxicology, 1977.
Karlson, Karl E., Adjunct Professor of Electrical Engineering, 1974.
Katayama, Teruhisa, Adjunct Professor of Food Science and Nutrition, 1979.
Kavarnos, George J., Adjunct Professor of Chemistry, 1978.
Klyberg, Albert T., Adjunct Associate Professor of History, 1977, 1976.
Knott, J. Eugene, Adjunct Associate Professor of Psychology and of Human Development, Counseling and Family Studies, 1981, 1975.
Lake, James L., Adjunct Professor of Oceanography, 1982.
Lal, Harbans, Adjunct Professor of Pharmacology and Toxicology, and Psychology, 1981.
Leco, Armand P., Adjunct Professor of Health Care Administration, 1978.
Lundgren, Raymond G. Jr., Adjunct Associate Professor of Pharmacology and Toxicology, 1975.
Malcolm. Alexander R., Jr., Adjunct Assistant Professor of Pharmacology and Toxicology, 1979.
Mayer, Larry A., Adjunct Professor of Ocean Engineering, 1981.
McCullough, William V., Adjunct Assistant Professor of Electrical Engineering, 1977.
Messier, Richard H., Adjunct Associate Professor of Mechanical Engineering and Applied Mechanics, 1982, 1977.
Miller, Donald C., Adjunct Professor of Zoology, 1979, 1975.
Miller, Eugene, Adjunct Assistant Professor of Pharmacology and Toxicology, 1970.
Morris, David J., Adjunct Professor of Biochemistry and Biophysics, 1980.
Most, Albert S., Adjunct Associate Professor of Electrical Engineering, 1974.
Nakanishi, Koji, Adjunct Professor of Pharmacognosy, 1974.
Osgood, Charles F., Adjunct Professor of Mathematics, 1980.
Owen, Albert J., Adjunct Assistant Professor of Biochemistry, 1978.
Patton, Alexander J., Adjunct Associate Professor of Mechanical Engineering and Applied Mechanics, 1977.
Pauly, Daniel, Adjunct Professor of Oceanography, 1982.
Pell, Claiborne D., Adjunct Professor of Geography and Marine Affairs, 1982.
Phelps, Donald K., Adjunct Assistant Professor of Oceanography, 1969.
Pogacar, Srecko J., Adjunct Associate Professor of Pharmacology, 1969.
Prager, Jan C., Adjunct Associate Professor of Microbiology, 1967.
Sahagian, Charles S., Adjunct Assistant Professor of Chemical Engineering, 1970.
Schenck, Hilbert Van N., Jr., Adjunct Professor of Mechanical Engineering and Applied Mechanics, 1982.
Sherman, Kenneth, Adjunct Professor of Oceanography, 1977.
Shonting, David H., Adjunct Professor of Oceanography, 1975.
Siino, Frederick A., Adjunct Professor of Environmental Health Science, 1981.
Silverman, Gerald, Adjunct Professor of Food and Nutritional Science, 1969.
Tenore, Kenneth R., Adjunct Professor of Oceanography, 1976.
Thomas, Carol J., Adjunct Professor of Community Planning and Area Development, 1971.
Treistman, Steven N., Adjunct Professor of Zoology, 1982.
Turner, Michael D., Adjunct Professor of Pharmacology and Toxicology, 1979.
Viccione, Daniel M., Adjunct Associate Professor of Computer Science, 1981.
Williams, David O., Adjunct Assistant Professor of Biomedical Engineering, 1977.
Wood, David, Adjunct Assistant Professor of Mathematics, 1976.

Clinical Appointments

Marr, Frank N., Jr., Clinical Assistant Professor of Pharmacy, 1982.
Owens, Norma J., Clinical Assistant Professor of Pharm.D., 1982.
Regan, J. Barry, Clinical Assistant Professor of Speech Communication, 1972.
Yashar, John J., Clinical Lecturer in Pharmacology, 1963.

Calendar

IMPORTANT NOTE: Requests for scheduling examinations must be submitted to the Graduate School Office at least ten days prior to the date(s) requested. Oral and written examinations, including qualifying and comprehensive examinations and defenses of theses, will not be scheduled during periods when the University is in recess. During the winter intersession and summer session, such examinations will be scheduled only at the convenience of the faculty members involved and depending upon the availability of the candidates' program committee and additional qualified examiners. Students wishing to take any such examinations during these sessions should first check as to the availability and convenience of the faculty members. Each faculty member must initial the request for scheduling the examination to indicate willingness to serve. If they are not registered for course work or research during the summer sessions, students wishing to take examinations should register for Continuous Registration.

Fall Semester 1982

August 30 - September 10
Registration period, College of Continuing Education.

September 7, Tuesday
Graduate registration, 8:00 a.m. to 5:00 p.m. Keaney Gymnasium. Fees must be paid at the time of registration. There is a $15 late registration fee for continuing students who register between September 8-10.

September 8, Wednesday
Classes begin, 8:00 a.m. Kingston Campus and College of Continuing Education.

September 13, Monday
There is a $50 late registration fee for continuing students who register on September 13, or thereafter.

September 21, Tuesday
Final date for adding courses.
Final date for pass/fail options and audit requests.

October 1, Friday
Final date for January master's degree candidates and May doctoral degree candidates to submit thesis proposals.
Final date for nominations for January graduation.

October 11, Monday
Holiday, Columbus Day.

October 22, Friday
Mid-semester.
Final date for dropping courses without grading and to change from pass/fail option to grade.

October 25-29
Advance registration for 1983 spring semester, Kingston Campus courses only.

November 2, Tuesday
Holiday, Election Day.

November 10, Wednesday
Thursday classes meet.

November 11, Thursday
Holiday, Veterans' Day.

November 25, Thursday
Thanksgiving recess begins, 8:00 a.m.

November 29, Monday
Classes resume, 8:00 a.m.
Final date for nominations from departments for tuition scholarships for spring semester. Nominations must be accompanied by a statement of financial need.

December 14, Tuesday
Classes end, Kingston Campus.

December 15-16
Reading days, Kingston Campus.

December 17, Friday
Programs of study due for students admitted for fall 1982.

December 17-18, 20-23
Final examinations, Kingston Campus.

December 21, Tuesday
Final date for January candidates to submit completed master's and doctoral theses in a form acceptable for examination purposes along with the request for oral defense of thesis. NO EXTENSIONS OF TIME WILL BE GRANTED. Theses must be submitted at least ten days prior to the date requested for oral defense.

Selection of date should allow sufficient time for necessary revisions and retyping before submission in final form. See deadline below and note at beginning of this calendar regarding scheduling examinations during the winter intersession.
College of Continuing Education classes and examinations end.

December 28, Tuesday
Final grades due in Registrar's Office, 4:00 p.m.

Spring Semester 1983

January 10-21
Registration period, College of Continuing Education.

January 17, Monday
Graduate registration, 8:00 a.m. to 5:00 p.m., Keaney Gymnasium.
Fees must be paid at the time of registration. There is a $15 late registration fee for continuing students who register between January 18-21.

January 18, Tuesday
Classes begin, 8:00 a.m., Kingston Campus and College of Continuing Education.
Final date for January degree candidates to submit master's and doctoral theses, which have been successfully defended in final form, 9:00 a.m. NO EXTENSIONS OF TIME WILL BE GRANTED.

January 21, Friday
Final date for May master's degree candidates and August doctoral degree candidates to submit thesis proposals.
Final date for nominations for May graduation.
Final date for submission of annual review of doctoral candidates.

January 24, Monday
There is a $50 late registration fee for continuing students who register on January 24 or thereafter.

January 31, Monday
Final date for adding courses.
Final date for pass/fail options and audit requests.

February 18, Friday
Final date for nominations from departments for URI fellowships.

February 21, Monday
Washington's Birthday, no classes.

February 22, Tuesday
Monday classes meet, Kingston Campus only.

March 9, Wednesday
Mid-semester.
Final date for dropping courses without grading and to change from pass/fail option to grade.

March 14, Monday
Spring recess begins, 8:00 a.m.

March 21, Monday
Classes resume, 8:00 a.m.

March 28-April 1
Graduate advance registration for 1983 fall semester, Kingston Campus courses only.

April 4, Monday
Final date for August master's degree and January doctoral degree candidates to submit thesis proposals.

April 20, Wednesday
Final date for May degree candidates to submit completed master's and doctoral theses in a form acceptable for examination purposes, along with the request for oral defense of thesis, 9:00 a.m. NO EXTENSIONS OF TIME WILL BE GRANTED. Theses must be submitted at least ten days prior to the date requested for the oral defense. Selection of date should allow sufficient time for necessary revisions and retyping before submission in final form. See deadline below.

April 22, Friday
Final date for nominations from departments for tuition scholarships for the 1983-84 academic year. Nominations must be accompanied by a statement of financial need.

May 4, Wednesday
Last day of classes, Kingston Campus.

May 5-6
Reading days, Kingston Campus.

May 6, Friday
Programs of study due for students admitted in January 1983.

May 9-14
Final examinations, Kingston Campus.

May 10, Tuesday
College of Continuing Education classes and examinations end.

May 17, Tuesday
Final date for all May degree candidates to submit master's and doctoral theses, which have been successfully defended in final form, 9:00 a.m. NO EXTENSIONS OF TIME WILL BE GRANTED.
Final grades due in Registrar's Office, 4:00 p.m.

May 29, Sunday
Commencement.

May 30, Monday
Holiday, Memorial Day.

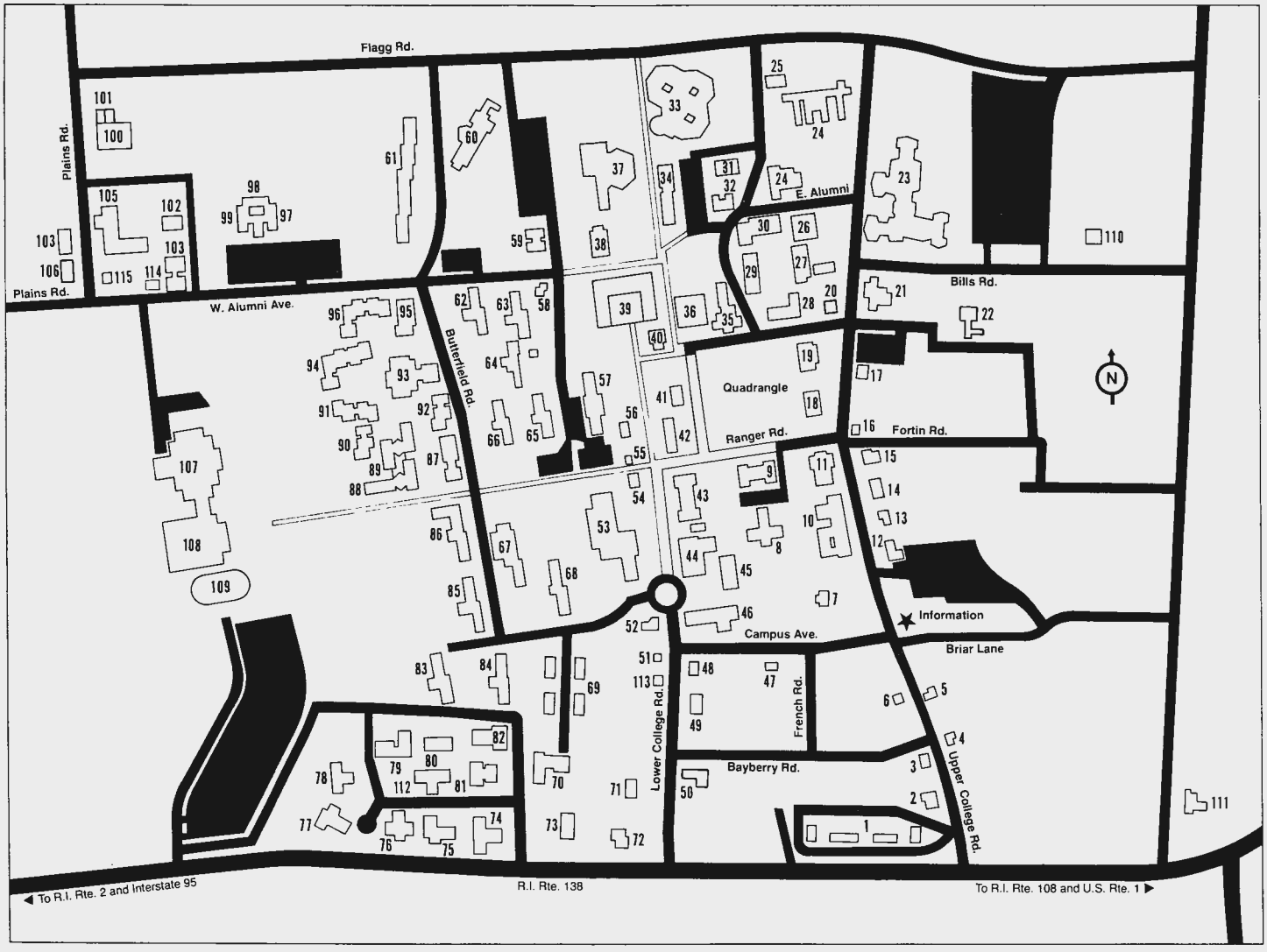
Summer Session 1983

NOTE: All courses taken by graduate students during summer sessions are subject to the same regulations regarding inclusion in programs of study and calculation of overall academic average, etc., as are courses taken during the regular academic year. Students wishing to take directed studies or special problems courses during summer sessions must obtain individual approval for these courses from the Summer Session Office unless the specific offering is listed in the Summer Session Bulletin for that year. Students wishing to enroll for thesis or dissertation research during summer sessions must ascertain first that their major professors and/or members of their thesis or dissertation committees will be available and are willing to provide the necessary supervision. See also the important note at the beginning of this calendar regarding scheduling of examinations, including defenses of theses, during summer session.

June 10, Friday
Final date for nominations for August graduation.

August 1, Monday
Final date for all August degree candidates to submit completed master's and doctoral theses in a form acceptable for examination purposes, along with the request for oral defense of the thesis. NO EXTENSIONS OF TIME WILL BE GRANTED. Theses must be submitted at least ten days prior to the date requested for the oral defense. Selection of date should allow sufficient time for necessary revisions and retyping before submission in final form. See deadline below.

August 22, Monday
Final date for all August degree candidates to submit master's and doctoral theses, which have been successfully defended in final form, 9:00 a.m. NO EXTENSIONS OF TIME WILL BE GRANTED.



Campus Map

Academic and Service Buildings

Adams House 16
*Administration Bldg. 42
*Administrative Services Ctr. *campus mail* 102
*Athletic Bubble 109
*Ballentine Hall *business administration* 36
*Biological Sciences Bldg. 33
*Bliss Hall *engineering* 28
Business Office 55
Catholic Ctr. 22
*Central Receiving 100
*Chafee Social Science Ctr. 37
*Christopher House *Hillel, fraternity mgrs.* 113
*Child Development Ctr. 71
Community Planning Office 6
Community Planning Laboratory 25
Commuters' Hostel *(Rte 138 W.)*
*Crawford Hall *chemical engineering* 29
Davis Hall 41
East Farm *aquaculture and pathology (off Rte. 108)*
East Hall *physics* 19
*Edwards Hall 11
Episcopal Ctr. 50
Fine Arts Ctr. 23
Fire Station 110
*Fogarty Health Science Bldg. *pharmacy* 46
Garage 99
*Gilbreth Hall *industrial engineering* 26
*Green Hall 8
*Greenhouses 24
Human Transition Center 72
*Independence Hall 10
International Student Center 48
*Keaney Gymnasium 108
*Kelley Hall *electrical engineering* 30
Landscape and Grounds 98
*Library 39
Lippitt Hall 35
*Memorial Union 53
Minority Student Center 5
*Morrill Science Bldg. *life sciences* 45
*Pastore Chemical Laboratory and Annex 44
Peckham Farm *animal science (off Rte 138 W.)*
Personnel and Payroll 56
Pharmacy Annex 51
Plains Field House *(Plains Rd.)*
Planetarium 20
*Police 52
*Potter Bldg. *health services* 87
Property and Space 101
Purchasing 54

*Quinn Hall *human science and services* 43
Ranger Hall *biological sciences* 9
Riding Stables *(off Rte. 138 W.)*
Rifle Range 106
*Rodman Hall *library school* 38
*Roosevelt Hall *student services* 57
Ruggles House *Ocean Management Studies* 4
Safety and Health 114
*Sherman Bldg. *maintenance* 105
Taft Hall 40
*Tootell Physical Education Ctr. 107
Tucker House 17
Turf Field House *(Plains Rd.)*
*Tyler Hall *academic computer* 31
*Wales Hall *mechanical engineering* 27
Warehouses 103
Washburn Hall 18
Watson House 58
*White Hall *nursing* 60
Women's Center 115
*Woodward Hall *resource development* 34

Residence and Dining Halls

*Adams Hall 85
Aldrich Hall 95
*Barlow Hall 84
Bressler Hall 68
*Browning Hall 86
*Burnside Hall 96
*Butterfield Hall *residence and dining* 67
Coddington Hall 94
*Dorr Hall 91
Ellery Hall 90
Faculty Apartments 1
*Fayerweather Hall 89
Fernwood Apartments *(Rte. 138 W.)*
*Gorham Hall 88
Graduate Housing *(off Rte. 138 opposite fraternity village)*
*Heathman Hall 61
*Hope Hall *dining* 64
*Hopkins Hall 92
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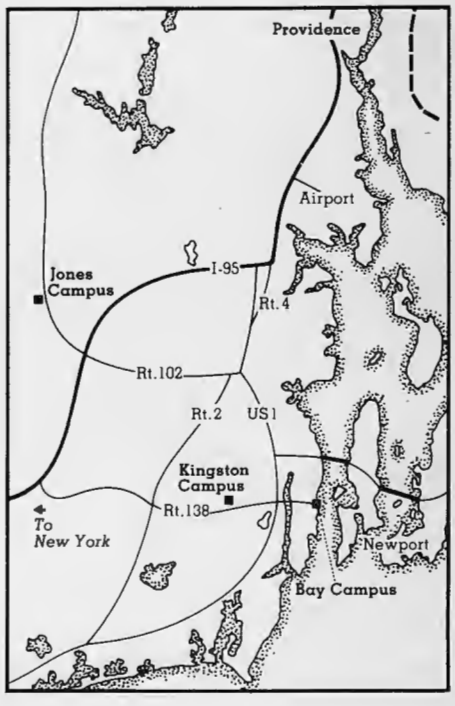
Alpha Epsilon Pi 82
Alpha Xi Delta 78
Chi Omega 79
Chi Phi 12
Delta Zeta 75
Lambda Chi Alpha 111
Phi Gamma Delta 59

Phi Kappa Psi 81
Phi Sigma Kappa 3
Sigma Alpha Epsilon 13
Sigma Chi 14
Sigma Delta Tau 77
Sigma Kappa 76
Sigma Nu 15
Sigma Phi Epsilon 112
Sigma Pi 74
Tau Epsilon Phi 47
Tau Kappa Epsilon 49
Theta Chi 2
Theta Delta Chi 32
Zeta Beta Tau 80



*Accessible to the handicapped

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UNIVERSITY OF RHODE ISLAND
GRADUATE SCHOOL
APPLICATION INFORMATION

Thank you for your interest in the University of Rhode Island Graduate School. The information provided below is designed to ensure that your application receives the earliest possible consideration. The application for financial assistance is on the reverse side of this information sheet. If you wish to be considered for an award, please be sure to enclose this sheet with your application for admission.

1) To apply for admission to graduate study the following items must be sent to:

The Graduate Admissions Office
University of Rhode Island
Green Hall
Kingston, Rhode Island 02881 Telephone: 401-792-2872

Please do not send application materials to academic departments or to faculty members. Before your application can be considered, all materials must be received by the Graduate Admissions Office.

APPLICATION MATERIALS REQUIRED FOR CONSIDERATION: (1) Two completed, signed and dated copies of this application; (2) two official transcripts from the Registrar's Office of each undergraduate and graduate institution attended; (3) two official copies of the Graduate Record Examination scores from the Educational Testing Service (see item 11 on the admission application and the Graduate Bulletin for substitute tests); (4) three letters of recommendation as outlined in item 12 on the admission application; (5) a $15.00 non-refundable application fee – check or money order – payable to The University of Rhode Island (please do not send cash).

2) APPLICATION DEADLINES: The general deadlines for receipt of applications and all supporting documents are:

April 15 for September and Summer Session admission
November 15 for January admission

PLEASE NOTE: Certain graduate programs have earlier deadlines which are published by program in the Graduate Bulletin. Some programs do not have entry for the January term and are so identified in the Bulletin. To determine the exact deadline for the program of your interest, please consult the Graduate Bulletin or contact the Graduate Admissions Office.

3) LETTERS OF REFERENCE: Three letters of reference are required of all applicants to degree programs. Some certification programs require two (2) letters of recommendation. Please consult the Graduate Bulletin for information regarding teacher certification programs or contact the Graduate Admissions Office. The Letter of Reference Forms attached to the admission application MUST be submitted along with the letters of recommendation. In order to record the receipt of letters of recommendation prior to receipt of your application for admission, we ask that you record your SOCIAL SECURITY NUMBER on the reference form. Please send the reference form to your referee requesting that it be returned with the recommendation.

4) PROGRAM OFFERINGS: The reverse side of the admission application form lists the programs currently offered by the Graduate School. New programs authorized after the printing of this application are attached. The program name and the program code number listed must be entered to items 5 and 6 and to item 8 if applicable.

The program list does not contain all specialty areas within programs offered. To determine the specialty areas for each program please consult the Graduate Bulletin or contact the Graduate Admissions Office. For more specific information regarding specialty areas please feel free to contact academic departments.

5) ADMISSION: The Dean of the Graduate School is the only person authorized to admit applicants to graduate study, waive any requirements or notify applicants of the disposition of their applications. Communication from others must be considered unofficial and informal. It is not possible for the Graduate School to ensure that applications completed after the deadline for receipt of applications and supporting documents can be considered. If applications received after the published deadlines are considered we cannot guarantee processing of the application for the starting date desired. Admission is offered for a specific starting date and your application must be reconsidered if you subsequently request a postponement of your starting date.

All application materials become the property of the University of Rhode Island and cannot be returned to you or forwarded to other institutions. Incomplete application material and material received from accepted applicants who do not register will be held for a maximum of two years and then destroyed.

Admission to the Graduate School is based upon academic qualifications and potential without regard to age, sex, race, religion, or national origin.

GRADUATE SCHOOL BULLETINS and/or additional application forms are available. If you have any questions, please contact the Graduate Admissions Office. We will do our best to assist you in every possible way.

FOR OFFICIAL USE ONLY:

UNIVERSITY OF RHODE ISLAND
GRADUATE SCHOOL
FINANCIAL AWARD APPLICATION

This form should be used only by applicants seeking admission to the Graduate School who also wish to be considered for an award. To be eligible for any form of assistance you must first be admitted to the Graduate School. Please submit this form with your application for admission.

Awards for scholarships and fellowships are made by the Committee on Fellowships and Scholarships from ranked lists of nominees submitted by department chairmen. Graduate Assistantship appointments are initiated by department chairmen and Research Assistantships are initiated by the Principal Investigator of the grant involved. Financial need is a criterion for scholarships and assistantships and the only criterion for loan awards but is not a consideration for fellowships.

Indicate type(s) of award for which you wish consideration:	YES	NO
1) Tuition Scholarships – Awarded to qualified students demonstrating financial need.	____	____
2) Fellowships – Awarded to Ph.D. candidates in recognition of achievement and promise as scholars.	____	____
3) Graduate Assistantships – Awarded to provide teaching and research training; URI sponsored.	____	____
4) Graduate Research Assistantships – Awarded to provide research training; GRANT sponsored.	____	____
5) Loans – National Direct Student Loans, Work-Study. If you check this item, the URI Financial Aid Office will send you information on how to apply. Foreign students are NOT eligible.	____	____

Social Security No. |_|_|_|_|_|_|_|_|_| Program for which you are applying _____
(see reverse side of admission application)

NAME: _____ State of Residency _____
(Country if not U.S. Citizen)

Only applicants interested in scholarships and assistantships should complete the questionnaire below.

Estimated Budget for next academic year June through May: (employment income should be after tax dollars)

INCOME	APPLICANT	SPOUSE	APPLICANT AND SPOUSE
1. Employment (Summer and/or Part-time)	$_____	$_____	$_____
2. Support from Family or Parents	_____	_____	_____
3. Other (savings, etc.)	_____	_____	_____
4. Total Income	$_____	$_____	$_____
EXPENSES: (include spouse if spouse will also be a student. Name of school spouse will attend)			
1. Tuition and fees	$_____	$_____	$_____
2. Books	_____	_____	_____
3. Equipment and supplies	_____	_____	_____
4. Rent or mortgage including heat and utilities	_____	_____	_____
5 Food and household supplies	_____	_____	_____
6. Clothing, laundry, and cleaning	_____	_____	_____
7. Auto insurance premiums	_____	_____	_____
8. Other transportation expenses	_____	_____	_____
9. Medical and dental	_____	_____	_____
10. Child care	_____	_____	_____
11. Annual debt repayment (including educational loans)	_____	_____	_____
12. Total Expenses	$_____	$_____	$_____
FINANCIAL NEED: (Difference between total income and total expenses)	$_____	$_____	$_____

LOANS OUTSTANDING TO DATE: (include installment loans on cars, personal property, and loans for educational purposes)

SOURCE	AMOUNT	DATE	BALANCE	AMOUNT PAID BY MONTH/QUARTER
	$		$	$ /
	$		$	$ /
	$		$	$ /

SPECIFY ALL DEPENDENCY OBLIGATIONS:

SCHOLARSHIPS OR GRANTS PREVIOUSLY AWARDED:

(Source)	(Date)	(Amount)
(Source)	(Date)	(Amount)

Applicant's Signature Date

UNIVERSITY OF RHODE ISLAND

GRADUATE SCHOOL APPLICATION

APPLICANT: To ensure your application receives the earliest possible consideration, send all materials to THE GRADUATE ADMISSIONS OFFICE. Please do not send application materials to academic departments.

PLEASE PRINT ALL RESPONSES

1. Social Security No. ___ ___ ___ Starting Date Desired: January 19___, June 19___, September 19___

2. Name ___ ___ ___
Last First MI Previous or Maiden Name

3. Permanent Address ___ ___ Phone ___
Street Address/Apartment Number Area Code Number

___
City or Town

___
State Zip Code LEGAL STATE OF RESIDENCE ___

4. Current Mailing Address ___ ___ Phone ___
Street Address/Apartment Number Area Code Number

___
City or Town

___
State Zip Code

5. Academic Program Desired: ___
(see reverse side)

6. Program Code (see reverse side): ___ Objective: PHD ___; MS___; MA___ ; MBA___ ; MCP___; MLS ___; MMA___;
MPA___ ; MOM ___; TCP___; GCP___ ; NON-DEGREE___

7. Expected Registration: Full Time___; Part Time___; AT: Kingston Campus___; Extension Division___

8. Have you made prior application to the GRADUATE SCHOOL? ___ YES Program: ___ CODE: ___ DATE ___
(see reverse side)
___ NO Disposition of prior application ___

9. Colleges and universities attended. Please begin with your most recent enrollment and include all work completed at the University of Rhode Island including Extension, work taken in Non-Degree status and specify if you are currently enrolled. TRANSCRIPTS must be sent directly to the GRADUATE ADMISSIONS OFFICE.

NAME	OFFICE USE ONLY	DATES ATTENDED	MAJOR	DEGREE/CREDITS	Year Degree Awarded	Estimated G.P.A. on 4.0 Scale

10. Citizenship: Check One U.S. Citizen ___ ; Immigrant ___ ; Non Immigrant ___ ; Visa Status Number ___

The information below is requested but NOT required. Information related to racial ethnic origin is gathered only to report accurate totals to the Department of Health, Education and Welfare in compliance with Title VI of the Civil Rights Act of 1964.

Date of Birth ___ (MO. DAY YR.) Sex Female ___ Male ___ Married Yes ___ No ___ Number of Dependents ___

Black ((Not of Hispanic Origin)___; Hispanic___; Asian or Pacific Islander___; American Indian or Alaskan Native___;

Portuguese___; Cape Verdian (Not of Hispanic Origin)___; Caucasian___

Are any members of your immediate family alumni of the University of Rhode Island? Yes ___ No ___

11. The Graduate Record Examination is required of all applicants unless a specific substitute is listed in the Graduate Bulletin under the Admissions Requirements for the program for which you are applying. Please indicate below the date on which you took the specified test and your scores, if known, and ARRANGE TO HAVE COPIES OF THE OFFICIAL TEST REPORT SENT DIRECTLY TO THE GRADUATE ADMISSIONS OFFICE. If you have not yet taken the test, indicate below the name of the test and the date on which you plan to take the test:

TEST _____ DATE _____

GRE _____ / _____ / _____ MAT _____ / _____ GMAT _____ / _____ / _____
Verbal Quantitative Advanced Score/Percent Verbal Quantitative Total

12. The names and addresses of three persons who know you, your work, and your talent for and interest in advanced study, whom you have requested to write in support of your application. Select your advisor and/or other faculty members (preferably in your major field), employers, or supervisors, DO NOT request letters from relatives, friends, co-workers or others who have not supervised you in some professional capacity. Please read the instructions for letters of reference enclosed with this application, put your SOCIAL SECURITY NUMBER on the reference form, and have your referee return the form and letter to the GRADUATE ADMISSIONS OFFICE. Be sure your PROGRAM CODE number is printed on the reference form.

_____

_____

_____

13. Indicate original work or investigations, if any, if published, and give complete references. (Attach reprint if available).

_____

_____

_____

14. State the more important academic, professional or business positions you have held since receiving the baccalaureate degree (if applicable). Indicate the name of the institution or firm and the dates and type of employment.

(a) Present Employer _____

(b) 1st Prior _____

(c) 2nd Prior _____

15. Attach **TWO COPIES** of a statement of purpose of approximately 300 words indicating your objectives in undertaking graduate study to this application. In reviewing applications, considerable importance is placed on the applicant's interest in and commitment to advanced study and professional improvement.

Signature of Applicant _____ Date _____

(Please be sure that two official copies of your transcripts, statement of purpose, test scores, $15 application fee, three letters of recommendation, as well as your application is sent to the GRADUATE ADMISSIONS OFFICE)

ACADEMIC PROGRAMS AND PROGRAM CODES: Please transpose exactly the program name and program code which corresponds to the program for which you are applying. Enter the name on line 5 and the code on line 6. If you have previously applied to the Graduate School, enter the name and program code on line 8 indicating the starting date you desired and the action, if any, taken on your previous application. Applications for non-degree status in Psychology programs cannot be accepted. Permission to enroll must be granted by the Department Chairman on a term by term basis. Specific entrance requirements for Teacher Certification, Graduate Certificate and other certificate programs may be found in the Graduate Bulletin, or you may contact the Graduate Admissions Office.

DOCTOR OF PHILOSOPHY	CODE
Animal Pathology	233
Applied Math Sciences	027
Biochemistry — Biophysics	008
Botany	009
Chemical Engingeering	410
Chemistry	021
Civil & Environmental Engineering	420
Economics — Marine Resource	061
Electrical Engineering	430
English	060
Food Science & Nutrition	232
Mathematics	031
Mechanical Engineering & Applied Mechanics	450
Medicinal Chemistry	710
Microbiology	007
Ocean Engineering	460
Oceanography — Biological	960
Oceanography — Chemical	961
Oceanography — Geological	962
Oceanography — Physical	963
Pharmacognosy	720
Pharmacology & Toxicology	730
Pharmacy	705
Physics	047
Plant Pathology — Entomology	237
Psychology — Clinical	016
Psychology — General. Exp.	017
Psychology — School	018
Resource Chemistry	254
Zoology	111

MASTER OF ARTS	CODE
Comparative Literature	042
Economics	057
Education	
Counseling & Guidance	515
Educational Research	516
Elementary	517
Reading	518
Secondary English	519
Secondary History	520
Secondary Languages	521
Secondary Math & Science	522
Youth and Adult	524
English	060
French	071
Geography	062
History	065
Marine Affairs	012
Philosophy	079
Political Science	080
Sociology	085
Spanish	078
Speech — Audiology	063
Speech — Pathology	053

MASTER OF SCIENCE	CODE
Accounting	310
Animal Pathology	233
Animal Science	210
Biochemistry — Biophysics	008
Botany	009
Business Education	320
Chemical Engineering	410
Chemistry	021
Child Development & Family Relations	510
Marriage & Family Counseling	511

MASTER OF SCIENCE (Cont.)	CODE
Civil & Environmental Engineering	420
Computer Science	022
Electrical Engineering	430
Environmental Health Sci.	006
Experimental Statistics	023
Food Science & Nutrition	232
Geology	024
Home Economics Education	530
Industrial Engineering	440
Mathematics	031
Mechanical Engineering & Applied Mechanics	450
Medicinal Chemistry	710
Microbiology	007
Nursing	605
Nursing — Nurse Practitioner	615
Ocean Engineering	460
Oceanography — Biological	960
Oceanography — Chemical	961
Oceanography — Geological	962
Oceanography — Physical	963
Pharmacognosy	720
Pharmacology & Toxicology	730
Pharmacy	705
Pharmacy Administration	750
Physical Education — General	580
Physical Education — Health	581
Physical Education — Recreation	582
Physics	047
Plant & Soil Science	236
Plant Pathology — Entomology	237
Psychology — School	018
Resource Chemistry	254
Resource Economics	235

MASTER OF SCIENCE (Cont.)	CODE
Speech — Audiology	064
Speech — Pathology	054
Textiles, Clothing & Related Arts	540
Zoology	111

PROFESSIONAL DEGREES	CODE
Business Administration (MBA)	370
Community Planning (MCP)	270
Library Science (MLS)	940
Marine Affairs (MMA)	013
Master of Music (MOM)	070
Public Administration (MPA)	046
Librarianship (DAL)	941
Doctor of Pharmacy (PMD)	708

TEACHER CERTIFICATION (Be sure to check TCP on front of application)	CODE
Elementary or Secondary	513
Business Education	320
Nursery or Kindergarten	510

GRADUATE CERTIFICATE	CODE
Commercial Fisheries	972
International Development	971

NON-DEGREE

If you plan to apply for degree status at a later date and wish guidance from a department use the degree codes above but check non-degree on the front of the application. If you do not want a department affiliation use the code below:

Continuing Non-Degree 991

UNIVERSITY OF RHODE ISLAND

GRADUATE SCHOOL APPLICATION

APPLICANT: To ensure your application receives the earliest possible consideration, send all materials to THE GRADUATE ADMISSIONS OFFICE. Please do not send application materials to academic departments.

PLEASE PRINT ALL RESPONSES

1. Social Security No. ___-___-____ Starting Date Desired: January 19__, June 19__, September 19__

2. Name _____ _____ _____ _____
Last First MI Previous or Maiden Name

3. Permanent Address _____ Phone _____
Street Address/Apartment Number Area Code Number

_____
City or Town

_____
State Zip Code LEGAL STATE OF RESIDENCE _____

4. Current Mailing Address _____ Phone _____
Street Address/Apartment Number Area Code Number

_____
City or Town

_____
State Zip Code

5. Academic Program Desired: _____
(see reverse side)

6. Program Code (see reverse side): ____ Objective: PHD ___; MS___; MA___ ; MBA___ ; MCP___; MLS ___; MMA___ ;
MPA___ ; MOM ___; TCP___; GCP___ ; NON-DEGREE___

7. Expected Registration: Full Time___; Part Time___; AT: Kingston Campus___; Extension Division___

8. Have you made prior application to the GRADUATE SCHOOL? ___ YES Program: _____ CODE: ____ DATE _____
(see reverse side)
___ NO Disposition of prior application _____

9. Colleges and universities attended. Please begin with your most recent enrollment and include all work completed at the University of Rhode Island including Extension, work taken in Non-Degree status and specify if you are currently enrolled. TRANSCRIPTS must be sent directly to the GRADUATE ADMISSIONS OFFICE.

NAME	OFFICE USE ONLY	DATES ATTENDED	MAJOR	DEGREE/CREDITS	Year Degree Awarded	Estimated G.P.A. on 4.0 Scale

10. Citizenship: Check One U.S. Citizen ___ ; Immigrant ___ ; Non Immigrant ___ ; Visa Status Number _____

The information below is requested but NOT required. Information related to racial ethnic origin is gathered only to report accurate totals to the Department of Health, Education and Welfare in compliance with Title VI of the Civil Rights Act of 1964.

Date of Birth ___-___-___ (MO. DAY YR.) Sex Female ___ Male ___ Married Yes ___ No ___ Number of Dependents _____

Black ((Not of Hispanic Origin)___; Hispanic___; Asian or Pacific Islander___; American Indian or Alaskan Native___;

Portuguese___; Cape Verdian (Not of Hispanic Origin)___; Caucasian___

Are any members of your immediate family alumni of the University of Rhode Island? Yes ___ No ___

11. The Graduate Record Examination is required of all applicants unless a specific substitute is listed in the Graduate Bulletin under the Admissions Requirements for the program for which you are applying. Please indicate below the date on which you took the specified test and your scores, if known, and ARRANGE TO HAVE COPIES OF THE OFFICIAL TEST REPORT SENT DIRECTLY TO THE GRADUATE ADMISSIONS OFFICE. If you have not yet taken the test, indicate below the name of the test and the date on which you plan to take the test:

TEST _____ DATE _____

GRE ____ / ____ / ____ MAT ____ / ____ GMAT ____ / ____ / ____

Verbal Quantitative Advanced Score/Percent Verbal Quantitative Total

12. The names and addresses of three persons who know you, your work, and your talent for and interest in advanced study, whom you have requested to write in support of your application. Select your advisor and/or other faculty members (preferably in your major field), employers, or supervisors, DO NOT request letters from relatives, friends, co-workers or others who have not supervised you in some professional capacity. Please read the instructions for letters of reference enclosed with this application, put your SOCIAL SECURITY NUMBER on the reference form, and have your referee return the form and letter to the GRADUATE ADMISSIONS OFFICE. Be sure your PROGRAM CODE number is printed on the reference form.

_____

_____

_____

13. Indicate original work or investigations, if any, if published, and give complete references. (Attach reprint if available).

_____

_____

_____

14. State the more important academic, professional or business positions you have held since receiving the baccalaureate degree (if applicable). Indicate the name of the institution or firm and the dates and type of employment.

(a) Present Employer _____

(b) 1st Prior _____

(c) 2nd Prior _____

15. Attach **TWO COPIES** of a statement of purpose of approximately 300 words indicating your objectives in undertaking graduate study to this application. In reviewing applications, considerable importance is placed on the applicant's interest in and commitment to advanced study and professional improvement.

Signature of Applicant _____ Date _____

(Please be sure that two official copies of your transcripts, statement of purpose, test scores, $15 application fee, three letters of recommendation, as well as your application is sent to the GRADUATE ADMISSIONS OFFICE)

ACADEMIC PROGRAMS AND PROGRAM CODES: Please transpose exactly the program name and program code which corresponds to the program for which you are applying. Enter the name on line 5 and the code on line 6. If you have previously applied to the Graduate School, enter the name and program code on line 8 indicating the starting date you desired and the action, if any, taken on your previous application. Applications for non-degree status in Psychology programs cannot be accepted. Permission to enroll must be granted by the Department Chairman on a term by term basis. Specific entrance requirements for Teacher Certification, Graduate Certificate and other certificate programs may be found in the Graduate Bulletin, or you may contact the Graduate Admissions Office.

DOCTOR OF PHILOSOPHY	CODE
Animal Pathology	233
Applied Math Sciences	027
Biochemistry — Biophysics	008
Botany	009
Chemical Engingeering	410
Chemistry	021
Civil & Environmental Engineering	420
Economics — Marine Resource	061
Electrical Engineering	430
English	060
Food Science & Nutrition	232
Mathematics	031
Mechanical Engineering & Applied Mechanics	450
Medicinal Chemistry	710
Microbiology	007
Ocean Engineering	460
Oceanography — Biological	960
Oceanography — Chemical	961
Oceanography — Geological	962
Oceanography — Physical	963
Pharmacognosy	720
Pharmacology & Toxicology	730
Pharmacy	705
Physics	047
Plant Pathology — Entomology	237
Psychology — Clinical	016
Psychology — General. Exp.	017
Psychology — School	018
Resource Chemistry	254
Zoology	111

MASTER OF ARTS	CODE
Comparative Literature	042
Economics	057
Education	
Counseling & Guidance	515
Educational Research	516
Elementary	517
Reading	518
Secondary English	519
Secondary History	520
Secondary Languages	521
Secondary Math & Science	522
Youth and Adult	524
English	060
French	071
Geography	062
History	065
Marine Affairs	012
Philosophy	079
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Sociology	085
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Doctor of Pharmacy (PMD)	706

TEACHER CERTIFICATION (Be sure to check TCP on front of application)	CODE
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International Development	971

NON-DEGREE

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Continuing Non-Degree	991

UNIVERSITY OF RHODE ISLAND
GRADUATE SCHOOL – REQUEST FOR LETTER OF REFERENCE
APPLICANT: Please send these forms to your Referees

Starting date desired January 19 ___ June 19 ___ September 19 ___

TO: _____
(Referee's Name) (Please Print)

Social Security Number

_____ has applied for admission to graduate
(Applicant's Name) (Please Print)
study to pursue a _____ degree in _____ at the University of Rhode Island. Would you kindly assist us by indicating in an attached letter, how well and in what capacities you know the applicant; your estimate of abilities, creativeness, integrity, motivation and potential for teaching, research, administration and/or other professional endeavors? Please describe briefly any unusual attributes which would be of help in making a fair judgment about the application.

Please attach this form to the letter and mail them directly to the Graduate Admissions Office, University of Rhode Island, Green Hall, Kingston, Rhode Island 02881. You are encouraged to discuss the contents of the letter with the applicant. While third party confidentiality is guaranteed under the Family Education Rights and Privacy Act, the applicant has the right to view the letter and procure a copy after he/she is accepted and enrolled, unless that right is waived below. Return of this form with your letter will speed the consideration of the applicant's application. Thank you for your cooperation.

OPTIONAL WAIVER

APPLICANT: You are encouraged to discuss your letter of reference with your referee. As provided under the Family Education Rights and Privacy Act you may waive your right to view letters of reference. If you wish to do so, please sign below.

I hereby WAIVE my right to view the letter of reference from

_____ requested above.
(Referee's Name)

_____ _____
Applicant's Signature Date

UNIVERSITY OF RHODE ISLAND
GRADUATE SCHOOL – REQUEST FOR LETTER OF REFERENCE
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_____ _____
Applicant's Signature Date